APPLETONS' HOME READING BOOKS

THE PLANT WORLD

VINCENT

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EDITED BY

WILLIAM T. HARRIS, A. M., LL. D.

UNITED STATES COMMISSIONER OF EDUCATION

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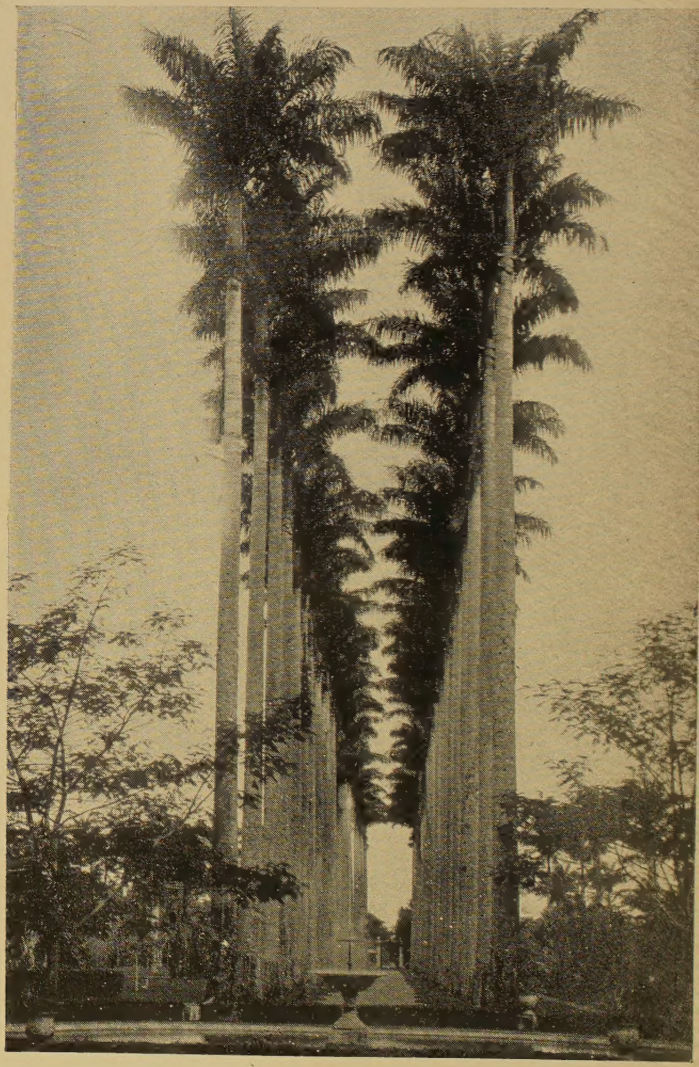

A Part of the Avenue of Royal Palms.

APPLETONS' HOME READING BOOKS

THE PLANT WORLD

ITS ROMANCES AND REALITIES

A READING-BOOK OF BOTANY

COMPILED AND EDITED BY

FRANK VINCENT, M. A.

AUTHOR OF ACTUAL AFRICA, AROUND AND ABOUT SOUTH AMERICA, ETC.

NEW YORK
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1897

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INTRODUCTION TO THE HOME READING BOOK SERIES BY THE EDITOR.

The new education takes two important directions—one of these is toward original observation, requiring the pupil to test and verify what is taught him at school by his own experiments. The information that he learns from books or hears from his teacher's lips must be assimilated by incorporating it with his own experience.

The other direction pointed out by the new education is systematic home reading. It forms a part of school extension of all kinds. The so-called "University Extension" that originated at Cambridge and Oxford has as its chief feature the aid of home reading by lectures and round-table discussions, led or conducted by experts who also lay out the course of reading. The Chautauquan movement in this country prescribes a series of excellent books and furnishes for a goodly number of its readers annual courses of lectures. The teachers' reading circles that exist in many States prescribe the books to be read, and publish some analysis, commentary, or catechism to aid the members.

Home reading, it seems, furnishes the essential basis of this great movement to extend education

beyond the school and to make self-culture a habit of life.

Looking more carefully at the difference between the two directions of the new education we can see what each accomplishes. There is first an effort to train the original powers of the individual and make him self-active, quick at observation, and free in his thinking. Next, the new education endeavors, by the reading of books and the study of the wisdom of the race, to make the child or youth a participator in the results of experience of all mankind.

These two movements may be made antagonistic by poor teaching. The book knowledge, containing as it does the precious lesson of human experience, may be so taught as to bring with it only dead rules of conduct, only dead scraps of information, and no stimulant to original thinking. Its contents may be memorized without being understood. On the other hand, the self-activity of the child may be stimulated at the expense of his social well-being—his originality may be cultivated at the expense of his rationality. If he is taught persistently to have his own way, to trust only his own senses, to cling to his own opinions heedless of the experience of his fellows, he is preparing for an unsuccessful, misanthropic career, and is likely enough to end his life in a madhouse.

It is admitted that a too exclusive study of the knowledge found in books, the knowledge which is aggregated from the experience and thought of other people, may result in loading the mind of the pupil with material which he can not use to advantage.

Some minds are so full of lumber that there is no space left to set up a workshop. The necessity of uniting both of these directions of intellectual activity in the schools is therefore obvious, but we must not, in this place, fall into the error of supposing that it is the oral instruction in school and the personal influence of the teacher alone that excites the pupil to activity. Book instruction is not always dry and theoretical. The very persons who declaim against the book, and praise in such strong terms the self-activity of the pupil and original research, are mostly persons who have received their practical impulse from reading the writings of educational reformers. Very few persons have received an impulse from personal contact with inspiring teachers compared with the number that have received an impulse from such books as Herbert Spencer's Treatise on Education, Rousseau's Émile, Pestalozzi's Leonard and Gertrude, Francis W. Parker's Talks about Teaching, G. Stanley Hall's Pedagogical Seminary. Think in this connection, too, of the impulse to observation in natural science produced by such books as those of Hugh Miller, Faraday, Tyndall, Huxley, Agassiz, and Darwin.

The new scientific book is different from the old. The old style book of science gave dead results where the new one gives not only the results, but a minute account of the method employed in reaching those results. An insight into the method employed in discovery trains the reader into a naturalist, an historian, a sociologist. The books of the writers above named have done more to stimulate original research on the

part of their readers than all other influences combined.

It is therefore much more a matter of importance to get the right kind of book than to get a living teacher. The book which teaches results, and at the same time gives in an intelligible manner the steps of discovery and the methods employed, is a book which will stimulate the student to repeat the experiments described and get beyond these into fields of original research himself. Every one remembers the published lectures of Faraday on chemistry, which exercised a wide influence in changing the style of books on natural science, causing them to deal with method more than results, and thus to train the reader's power of conducting original research. Robinson Crusoe for nearly two hundred years has stimulated adventure and prompted young men to resort to the border lands of civilization. A library of home reading should contain books that stimulate to self-activity and arouse the spirit of inquiry. The books should treat of methods of discovery and evolution. All nature is unified by the discovery of the law of evolution. Each and every being in the world is now explained by the process of development to which it belongs. Every fact now throws light on all the others by illustrating the process of growth in which each has its end and aim.

The Home Reading Books are to be classed as follows:

First Division. Natural history, including popular scientific treatises on plants and animals, and also de-

scriptions of geographical localities. The branch of study in the district school course which corresponds to this is geography. Travels and sojourns in distant lands; special writings which treat of this or that animal or plant, or family of animals or plants; anything that relates to organic nature or to meteorology, or descriptive astronomy may be placed in this class.

Second Division. Whatever relates to physics or natural philosophy, to the statics or dynamics of air or water or light or electricity, or to the properties of matter; whatever relates to chemistry, either organic or inorganic—books on these subjects belong to the class that relates to what is inorganic. Even the so-called organic chemistry relates to the analysis of organic bodies into their inorganic compounds.

Third Division. History and biography and ethnology. Books relating to the lives of individuals, and especially to the social life of the nation, and to the collisions of nations in war, as well as to the aid that one gives to another through commerce in times of peace; books on ethnology relating to the manners and customs of savage or civilized peoples; books on the primitive manners and customs which belong to the earliest human beings—books on these subjects belong to the third class, relating particularly to the human will, not merely the individual will but the social will, the will of the tribe or nation; and to this third class belong also books on ethics and morals, and on forms of government and laws, and what is included under the term civics or the duties of citizenship.

Fourth Division. The fourth class of books includes more especially literature and works that make known the beautiful in such departments as sculpture, painting, architecture and music. Literature and art show human nature in the form of feelings, emotions, and aspirations, and they show how these feelings lead over to deeds and to clear thoughts. This department of books is perhaps more important than any other in our home reading, inasmuch as it teaches a knowledge of human nature and enables us to understand the motives that lead our fellow-men to action.

To each book is added an analysis in order to aid the reader in separating the essential points from the unessential, and give each its proper share of attention.

W. T. Harris.

Washington, D. C., *November 16, 1896.*

PREFACE.

PROFESSOR JOHONNOT, author of valuable works on the principles and practice of teaching, has well said that "mechanical and unintelligent reading is the great reproach of our schools at the present time. In the process of instruction, whenever the attention is almost exclusively directed to words, such reading inevitably results. The cause of the evil at once suggests the remedy: make thought the primary object of attention, and regard words as important only as containing the thought."

The old-fashioned school readers do not meet these nor other vital requirements. Imperfectly arousing attention and interest, they are not calculated to form habits of observation, comparison, and deduction. Besides, they are so little entertaining and instructive that they rarely excite an eagerness and enthusiasm in students to afterward pursue the special subjects of which they treat. Literary, like more material food, should be palatable as well as nutritious.

It is not denied that successful attempts have lately been made to provide such feasts. We have

had excellent "readers" in science, in industry, and in both human and natural history. The fascinating field of botany, however, seems to have been quite overlooked, and yet surely no subject is better calculated to develop the mind and furnish knowledge of the greatest use and value.

In the range and diversity of the fifty extracts of the present volume an endeavor has been made to secure the lively interest which comes from broad and characteristic treatment, and poetry has been invoked in addition to prose, itself oftentimes scarcely less picturesque and romantic. The illustrations forcefully reproduce several salient features of the vegetable kingdom. They are unique in a work of this kind.

All the selections having been properly accredited, both in the text and in the Table of Contents, no further acknowledgment or additional detail is here thought necessary.

F. V.

New York, *December, 1896.*

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THE PLANT WORLD.

SPRING.

Fair-handed Spring unbosoms every grace,
Throws out the Snowdrop, and the Crocus first;
The Daisy, Primrose, Violet darkly blue,
And Polyanthus of unnumbered dyes;
The yellow Wallflower, stained with iron brown;
And lavish Stock that scents the garden round:
From the soft wing of vernal breezes shed,
Anemonies; Auriculas, enriched
With shining meal o'er all their velvet leaves;
And full Ranunculus, of glowing red.
Then comes the Tulip-race, where Beauty plays
Her idle freaks; from family diffused
To family, as flies the father-dust,
The varied colors run; and while they break
On the charmed eye, th' exulting florist marks,
With secret pride, the wonders of his hand.
No gradual bloom is wanting; from the bud,
First-born of Spring, to Summer's musky tribes:
Nor Hyacinths, of purest virgin white,
Low-bent, and blushing inward: nor Jonquils,

Of potent fragrance; nor Narcissus fair,
As o'er the fabled fountain hanging still;
Nor broad Carnations, nor gay-spotted Pinks;
Nor, showered from every bush, the Damask Rose.
Infinite numbers, delicacies, smells,
With hues on hues expression cannot paint,
The breath of Nature, and her endless bloom.

THOMSON.

TO A STUDENT OF BOTANY.

1. You are beginning the study of living things, and it is very important that you should begin in the right way. There are a few things that you ought to consider at the outset. First of all, it is essential that you should learn to see things just as they are, and to report exactly what you have seen. Agassiz used to say to his students: "Study to know what *is;* be courageous enough to say, 'I do not know.'" Tyndall said to the teachers at South Kensington: "In every one of your experiments endeavor to feel the responsibility of a moral agent. . . . If you wish to become acquainted with the truth of Nature, you must from the first resolve to deal with her sincerely." Darwin in his autobiography writes: "I had during many years followed a golden rule, namely, that whenever a published fact, a new observation or thought, came across me, which was opposed to my

general results, to make a memorandum of it without fail and at once, for I had found by experience that such facts and thoughts were far more apt to escape from the memory than favorable ones."

2. When you have seen a thing clearly, be sure to express your conception, whether by drawing, or written description, or both, as accurately as possible. Learn to use scientific language with precision. Write out your observations in full, in the best English at your command. Avoid abbreviations and every other device for saving time. Make your drawings so that an engraver could copy them. Do not hesitate to do your work all over again, if it can be improved, as it probably can be, and do not leave a thing until you have not only a complete observation, but a complete expression of it.

3. Do not be hasty in drawing conclusions. Make a constant practice of comparing the object you are studying with others of the same kind. Note differences and resemblances. Learn by the actual process what it is to acquire a general conception. "Honesty in science means, first, facts well proved, and then conclusions slowly and painfully deduced from facts well proved." In all your work *stop and think*. The mere accumulation of facts, if nothing is done with them, is of little consequence. Constantly ask the question, What does this fact mean? You may or may not be able to answer the question, but there is no reason for not raising it.

4. Cultivate self-reliance, but not self-sufficiency. Study things themselves rather than book descriptions

of them, but habitually use the books you are referred to, comparing point by point your own observations with what the authors have to say. The writers cited may or may not be right; they are more likely to be than you are; but both of you may be wrong. The best way is to observe for yourself, then consult the books; then observe again, and continue your observations and comparisons until the exact truth is ascertained. This is the way investigations are conducted, and you are learning how to investigate.

5. This leads to a word on the use of books. Make it a regular practice to look up the references that are given with the exercises. By doing this you will not only become acquainted with some of the most valuable botanical literature, but, what is more important, you will come, in some measure, to understand the habits and methods of the great workers in science, and will, perhaps insensibly to yourself, catch something of their spirit, and learn to work as they did, honestly, accurately, and "with infinite patience."

6. One of the greatest investigators who has ever lived wrote a few years ago: "Whenever I have found out that I have blundered, or that my work has been imperfect, and when I have been contemptuously criticised, and even when I have been overpraised, so that I have felt mortified, it has been my greatest comfort to say hundreds of times to myself that 'I have worked as hard and as well as I could, and no man can do more than this.'"

VOLNEY M. SPALDING, "Guide to the Study of Common Plants."

THE DATE-PALM.

I. The date-palm (*Phœnix dactylifera*) is often found to be the only tree cultivated and wild, not only in Arabia, but throughout the whole of northern Africa and the country of the Euphrates to the valley of the Indus. A line drawn from Cape Blanco to Cape Gardafui marks its southern limit in Africa; but there are many places besides where it will thrive as a cultivated tree. Even in Europe, in the southern parts of Spain, there exists a noble forest of fine date-palms, relics of the past Moorish civilization, and the tree has been transplanted to some parts of America with success. Its true home, however, is that part of the tropic zone where there is no rainfall, and where its roots are fed by the ground-water lying in the sand; since the hardness of the leaves and the thickness of their outer skin enable the tree to resist the heat of the sun. The palms can only thrive in the plains. In Syria they are found inland as far as the base of Lebanon; but they never grow on the heights, and are rarely found above 2,000 to 3,300 feet above the sea. On Mount Sinai they are said to flourish as high up as 1,638 feet above the sea; but beyond this they degenerate. Along their southern boundary they seem to prefer the coasts, and are found in great abundance upon the island of Socotra. Magnificent date forests are found throughout the delta of the Euphrates and the Tigris. In the

marshy depressions of the soil the stems of the wild palms take root; they do not grow here, as elsewhere, to a height of sixty feet, but form a dense undergrowth with their roots and offshoots. The fruit of the date-palm of Bagdad is still fine and pleasant flavored. The traveler, descending the mountains of Kurdistan towards Mesopotamia, meets with the first date-palm near Altyn Kopru (35° 40′ N. lat.), and its northern limit extends eastward from that place and parallel to the mountain chain which is hostile to its growth. But still farther eastward, where the coast is visited by the southwest monsoons, the conditions necessary to its healthy growth are lacking, and therefore it is only found in British India along the upper course of the Indus, and on the southwestern slopes of Cashmere.

2. It may be truly said of the date-palm, that no other plant has played such a part in the world's religion, in history, or in poetry. It ranks in this respect before the Egyptian lotus, the Celtic mistletoe, the lily of France, the genista (broom) of the Northmen, or the rose, thistle, and shamrock, of our own country. The writer of the Canticles borrows from its height and graceful beauty the imagery in which he depicts the royal maiden of whom he sings; and when the noble hero of the Grecian epic approaches the king's daughter Nausicaa with suppliant words, he says—

> "For never saw I yet one like to thee,
> Or man or woman; and I gaze with joy.
> So once in Delos have mine eyes beheld,

Beside Apollo's altar, a fair palm
Whose slender, graceful stem enthralled my sight;
For the earth holds not such another growth."

3. The palm is "the queen of the oasis, whose foot is bathed in water, and her head uplifted to the fire of heaven." No storm breaks or uproots her; no sunbeam penetrates through the sheltering roof of its feathery, rustling leaves, often more than three yards in length. Sheltering the spring of water, and protecting the growth of vegetables and low shrubs at her feet, she is the creator, ornament, protectress, and wealth of the oasis. The traveler looks with joy on the distant vision of her crown of leaves as they rise above the horizon of the desert; they are the sure sign of inhabited homesteads and a welcome resting place. The pleasant fruit, in shape and size like a plum, hangs down in rich clusters, and in many places, especially in Arabia, its sweet, pleasant-tasted fruit forms the daily bread of the inhabitants, and one of their most valuable articles of commerce. A single date tree bears yearly from five to six hundredweight. The fastidious European owns the delicacy of its flavor, although it is very rare that good specimens of the fruit are sold in Europe. But the tree has not always been what it has now become. The plains of the lower Euphrates and of the Tigris were the paradise where men cultivated and improved the life-giving tree, and whence it spread to other countries.

4. It is a remarkable fact in the history of civilization, only to be paralleled with the other fact that the dromedary, "the ship of the desert," was not

known in Africa until the third century of the Christian era; and yet the dromedary seems created especially for the Libyan Desert, and by its means the inaccessible region has been thrown open to men of other races and other religions. The camel and the date-palm, two blessings of creation, closely connected in the necessities of their existence, and apparently an integral part of desert life and scenery, do not even belong originally to desert lands. They are the product and growth of the inhabitants of the desert, who tamed the one, and developed the luscious honey-sweet fruit of the other, which made this part of the globe habitable. The palm in its present state of perfection makes life only too easy for its lord and master, giving him almost all he needs without any labor; and thus adding a link to his gloomy, indolent fatalism, and to the dignified repose with which he veils the hot passions slumbering below his assumed calm. We need not specify in greater detail the manifold uses of the date-palm; we content ourselves with referring, after Strabo and Plutarch, to the Persian or Babylonian hymn in which the praises of the date-palm are sung, and three hundred ways in which it may be used are fully set forth.

ANONYMOUS, "Wonders of Living Nature."

PITCHER-PLANTS.

1. There are some plants which have commended themselves to notice either by their singular form, peculiar habit, showy flowers, or beautiful odor. Before carnivorous plants attracted any attention on account of their flesh-devouring proclivities, the Pitcher-plants had acquired notoriety, not on account of their showy flowers or beautiful odors—because these are attractions which they do not possess—but simply on account of their singular form. The pitchers, from whence the name is derived, hang suspended at the ends of the leaves, of which they are simply prolongations and modifications. Most Pitcher-plants consist of a clump of long, narrow green leaves. The extremities of the latter are attenuated down to the midrib, which becomes reduced to a cord, at the end of which hang suspended, one from each of many of the leaves, a curious bag or pouch, not unlike a small and delicate jug or pitcher, with a smaller leaf-like flap hanging over the mouth like a lid. These pitchers usually contain a little fluid, looking like water, at the bottom, in which are drowned insects. Such were the Pitcher-plants to our forefathers, and they were regarded simply as "curiosities of vegetation." To us they are something more, now that their history is better known, and for reasons which it shall be our object to explain.

2. Botanically, the Pitcher-plants proper are known by the name of Nepenthes, an old classical name, the application of which to these plants is somewhat obscure. One writer has attempted an apology for it in the following manner: "I have often wondered why Linnæus gave to this genus the name of Nepenthes. Every reader of classic story remembers that when Telemachus reached the court of Menelaus, tired and famished, the beautiful Helen gave him nepenthe to drink. No one has ever been able to say what this nepenthe was, though no doubt one of the 'drowsy sirups of the East.' Johnson defines nepenthe as an 'herb that drives away sadness.' Linnæus, perhaps, intended to refer to the tankard-like structure, so like also in the original species to a hot-water jug with its lid. Sometimes I am disposed to think that old Homer may have meant by nepenthe no physical beverage, but the sweet graces of Helen's queenly and consummate hospitality and welcome, touching, as they did, her guest's inmost feelings of love and reverence. If so, Nepenthe is well applied to its present owner, for assuredly no plant appeals more strongly to our sense of the admirable and the unique."

3. These tropical plants can only be cultivated in hot-houses in this country, and hence there are many persons to whom they are utter strangers. It may be true that all recent horticultural exhibitions have included specimens, but there are thousands of unfortunate individuals who can never visit "flower-shows," although there are but few in the neighborhood of

the metropolis who could not search out the Pitcher-plant in that favorite holiday resort—Kew Gardens. Travelers have described for us the appearance of these plants in their native homes, and especially those who have visited Borneo and the other islands of the Indian archipelago. Among others, Mr. Alfred Wallace thus alludes to them. He says: "We had been told we should find water at Padangbatu, but we looked about for it in vain, as we were exceedingly thirsty. At last we turned to the Pitcher-plants, but the water contained in the pitchers (about half a pint in each) was full of insects, and otherwise uninviting. On tasting it, however, we found it very palatable, though rather warm, and we all quenched our thirst from these natural jugs."

4. And again, when at Borneo, the same traveler writes: "The wonderful Pitcher-plants, forming the genus Nepenthes of botanists, here reach their greatest development. Every mountain-top abounds with them, running along the ground or climbing over shrubs and stunted trees; their elegant pitchers hanging in every direction. Some of these are long and slender, resembling in form the beautiful Philippine lace-sponge, which has now become so common; others are broad and short; their colors are green, variously tinted, and mottled with red or purple. The finest yet known were obtained on the summit of Kini-balou, in northwest Borneo. One of the broad sort will hold two quarts of water in its pitcher. Another has a narrow pitcher twenty inches long, while the plant itself grows to the length of twenty

feet." In 1847, when Lindley published the second edition of his "Vegetable Kingdom," he recorded, with somewhat of doubt, the number of different species as six, whereas, so many have been discovered since, that we may consider them equal to five times that number.

5. There are, says Dr. Hooker, "upward of thirty species of Nepenthes, natives of the hotter parts of the Asiatic archipelago, from Borneo to Ceylon, with a few outlying species in New Caledonia, in tropical Australia, and in the Seychelles Islands on the African coast. The pitchers are abundantly produced, especially during the younger state of the plants. They present very considerable modifications of form and external structure, and vary greatly in size, from little more than an inch to almost a foot in length; one species indeed, from the mountains of Borneo, has pitchers which, including the lid, measure a foot and a half, and the capacious bowl is large enough to drown a small animal or bird."

6. In most species the pitchers are of two forms, one pertaining to the young, the other to the old state of the plant, the transition from one form to the other being gradual. Those of the young state are shorter and more inflated; they have broad fringed longitudinal wings on the outside, which are probably guides to lead insects to the mouth; the lid is smaller and more open, and the whole interior surface is covered with secreting glands. Being formed near the root of the plant, these pitchers often rest on the ground, and in species which do not form leaves near

the root they are sometimes suspended from stalks which may be fully a yard long, and which bring them to the ground. In the older state of the plant the pitchers are usually much longer, narrower, and less inflated, trumpet-shaped; the wings also are narrower, less fringed, or almost absent. The lid is larger and slants over the mouth, and only the lower part of the pitcher is covered with secreting glands, the upper part presenting a tissue of different character.

7. The difference of structure in these two forms of pitcher, considered in reference to their different positions on the plant, forces the conclusion on the mind that the one form is intended for ground game, the other for winged game. In all cases the mouth of the pitcher is furnished with a thickened corrugated rim, which serves three purposes: it strengthens the mouth, and keeps it distended; it secretes honey, and it is in various species developed into a funnel-shaped tube, that descends into the pitcher, and prevents the escape of insects, or into a row of incurved hooks, that are in some cases strong enough to retain a small bird, should it, when in search of water or of insects, thrust its body beyond a certain length into the pitcher. In one species (*Nepenthes bicalcarata*) there are also two strong pointed hooks, or teeth, which are directed downward towards the mouth of the pitcher. Such appendages would doubtless be of service in preventing the free exit of any large insect after it had once entered the pitcher.

8. The attractive surfaces of Nepenthes are two, those namely of the rim of the pitcher, and of the under surface of the lid, which is provided in almost every species with honey-secreting glands, often in great abundance. It is a singular fact that the only species known to the writer of these observations, in which the honey-glands on the lid were absent, was a species in which the lid, unlike that of other species, is thrown back horizontally. The secretion of honey on a lid so placed would tend to lure insects away from the pitcher instead of into it.

9. From the mouth downward, for a variable distance inside the pitchers, the glassy glaucous surface affords no foothold for insects. The rest is entirely occupied with the secretive surface, which consists of a cellular floor crowded with spherical glands in inconceivable numbers. Each gland resembles the honey-glands of the lid, semicircular, with the mouth downward, so that the secretive fluid all falls to the bottom of the pitcher. In one species three thousand of these glands were ascertained by Dr. Hooker to occur on a square inch of the inner surface of the pitcher, and upwards of a million in an ordinary-sized pitcher. The glands secrete the fluid which is contained at the bottom of the pitchers previous to their opening, and this fluid is alway acid. When the fluid is emptied out of a fully-formed pitcher, that has not received animal matter, it forms again, but in comparatively very small quantities, and the formation goes on for many days, even after the pitcher has been removed from the plant. "I do not find,"

says Dr. Hooker, "that placing inorganic substances in the fluid causes an increased secretion, but I have twice observed a considerable increase of fluid in pitchers after putting animal matter in the fluid."

10. A series of experiments performed with the pitchers of these Pitcher-plants, resembled those applied previously to the Sundews and Fly-trap, with similar results. White of egg, raw meat, fibrin, and cartilage were employed for feeding. In all cases the action was most evident, and in some surprising. After twenty-four hours' immersion, the edges of the cubes of white of egg were eaten away, and the surfaces gelatinized. Fragments of meat were rapidly reduced, and pieces of fibrin weighing several grains were dissolved, and had totally disappeared in two or three days. With cartilage the action was most remarkable. Lumps of this, weighing eight and ten grains, were half-gelatinized in twenty-four hours, and in three days the whole mass was greatly diminished, and reduced to a clear, transparent jelly.

11. That this action, which is comparable to digestion, is not wholly due to the secretion, as at first deposited, seems probable, since very little change took place in any of the substances when placed in the fluid drawn from the pitchers, and put in glass tubes, nor even in substances immersed in the pitchers, when the plants have been removed into a room the temperature of which was far below that of the normal temperature in which the plant flourishes. In the latter case, as soon as the plant was taken back

into a higher and more normal temperature, the immersed substances were immediately acted upon.

M. C. Cooke, "Freaks and Marvels of Plant Life."

VIRGIN FOREST IN BRAZIL.

1. I never entered one of these free wild sanctuaries, without a most profound emotion. It was not fear, it was not respect. I paid little heed to the spirits or the fairies of the wood. I recalled no legend, and the prophetic worship of the ancients of the mysteries of sacred forests in no degree inclined my soul toward the giant trees, these altars of shades.

2. It was the infinity, the mystery of this rich creation, gigantic and inexhaustible, the universal life, which beckoned me to enter. In the midst of this circulation of sap, this expansion of form, I felt myself small, feeble, powerless; the internal gloom, the night of science overwhelmed me, and the modern spirit of seeking possessed me with its fever. I admire the *savants*, who, bending over a herbal, say to you, "Study carefully the structure of internal tissues, mark the absence or the number of cotyledons, follow the evolution of the germs, verify the sex, and you can place every plant in one of the four classes of the vegetable kingdom."

3. Really is this all the difficulty? Is the secret of the life of plants a question of cotyledons? God

forbid that I should blaspheme patience and genius. The great masters of botany, Gesner, Adanson, Linnæus, and Laurent de Jussieu, having justly merited human gratitude, in giving us rules for examination, the natural affinities, and the organic analogies. But wherein have these methods and classifications revealed the being of the plant? To describe is not to explain, and the phenomenon is not the law. But yet, let museums be arranged, and cabinets secured, conservatories built; but if you should enter the primeval woods, and amuse yourself in counting the cotyledons, cyclopædias would not suffice to name, nor centuries to number!

4. Tropical forests resemble very little the great woods of Europe, where the species are grouped and massed. Here the infinitely varied natures are confusedly mingled.

5. A rich disorder marries plant, flower, and sap, life overflows in leaves and fruits, to the risk of dew-filled chalices. The carpet is no regular design of grasses, or cryptogamiæ, of herbs or mosses, it is a chaos of capricious vegetation, of enameled flowering, intermingled with giant ferns; and as for the trees, which shade or arch it, Nature and the winds have thrown them in by thousands, as the suns are scattered through space by the hand of God.

6. All that one can dare to attempt in this labyrinth is a general sketch of forms, a modest draught of the interior plan of these marvelous constructions.

7. The general appearance of a virgin forest such as is seen on the Brazilian hills, is that of a grove in

the form of an amphitheater. From the depths of the gorges rise the primitive trees, the trunks of which are hidden under a giant juicy growth, the shooting branches of which form an arch or basket. You would say the roots of the secondary plan gave the leaves and flowers; and so they rise from rank to rank, to the very summits where sometimes immense granite blocks appear above the last clusters of foliage, now bathed in sunshine, now crowned with clouds. Shading upward, from the deepest green to slaty gray, from a purple red to pure lilac and white, every shade, every tone, every delight of the eye in color is found on this forest mantle fringed with flowers.

8. But if you will penetrate the secret of the woods, its arrangements, its freaks and fantasies of architecture, you must go under the arch and wander as far as possible, opening a path, hatchet in hand. Then the internal economy of these wild woods, so wise in its disorder, is seen. The three elements are before us—herb, vine, and tree—and if we can fathom neither the mystery nor the power of the creations, we can at least study and follow in its external form this vast and rich organism. The grasses and modest woody plants, the Brazilian creepers with tuberous or fleshy roots, Eusentes, and Liseroles, with white or blue flowers, climb, creep, twist, and interlace themselves, while parasites are attached to the shrubs and trunks of the trees. These charming vampires all absorb the juices, but do they give nothing in return? Not a single one of these malvaceas but has its property, purgative or febrifuginous, and if medical botany

ever minutely studies these humble climbers, in root, bark, and flower, they will find more than one treasure. These plants secrete life.

9. Above the grasses and *Convolvulaceæ* rise the vines with hardy flexible branches. They run from tree to tree, enveloping the trunks almost to suffocation, describing curves and spirals stretching out into airy bridges, then descend, only to climb again like ladders. This vegetation is wild as caprice itself, and in its athletic evolutions it defies art and fantasy. It has undulations which charm, lines which astonish us. It involves everything, intermingles with everything, grasses, trees, branch and trunk, the lively orchids, which form cornices for the socles of the trees or flowers for their capitals. It is the gluttonous parasite, the butterfly, its kingdom is the whole forest.

10. The artist dreaming of monuments, studies the old cartoons of the museums, the Ionic, the Doric, the Corinthian, the Composite, the Tuscan orders, and the Mauresque with its rich carvings. Why does he not go to the forest and study the vine, that grand worker, which day and night alike advances, interlaces, constructs, and extends? He would find here all the divine forms of Grecian art, all the fantasies of the spirit of the present, but varied to infinity, attaching themselves to, and leaning upon, the two immortal conditions of beauty—strength and grace.

11. Callimachus, the sculptor-architect, formerly borrowed the acanthus leaf from the tomb of a Corinthian maiden, and this flower of art made him immortal. How many similar flowers might there not be

ravished from these virgin forests, and how fruitful would be the study of the full, rich, perspective of these marvelous constructions! Art, like Science, should renew itself, rejuvenate itself on the breast of Nature. There lies the path of the age.

12. And the dealers in wood, the wood-carvers, the fabricators of household furniture, those who furnish the raw material and the timber, what do they in their lumber-yards and work-shops with their nut-wood, their oak, and their northern pine? For building and for ornament, there are here hundreds and hundreds of varieties of trees tall and perfect, which spring up, develop and die, useless creations, substances ignored, forces lost.

13. Dye-woods, gum-producing and resinous trees, or trees with healing bark; what rich varieties would be found in these virgin forests! Many have been discovered, and a few have been classed; but what numbers of substances are still unknown, and how many precious juices are lost under the bark which covers them! Between the creeper which corrodes the trees at the foot, and the flowers which crown them, there are indeed many secrets and more than one specific.

14. But I have no inducement to the study of these matters. I belong neither to medicine, to the axe, nor to the plane; and regretting all these lost values, I enter the forest to dream there.

15. It is early morning, the sun gilds but does not penetrate the dark-green curtains. A single pencil of rays comes across the dry white branches of a light-

ning-stricken irribera, and caresses the red flowers of the ipomea at my feet. Little caravans on the march make a rustling in the leaves and grass. These are the travelers of the forest, insects, ants, and lizards, who go either to the harvest or the hunt.

16. Butterflies bend over the flower cups which the bees have visited. The tribe of neutral ants go out in squadrons seeking for the puceron; and the timid agouti, squat under the mosses, gnaws at the leaves and roots.

17. The water-hog—capibara—the deer, and the tapir, they breakfast farther away under retired bowers at the foot of precipices; and one might go for leagues through the wood without finding the ounce; the striped huntress is in pursuit of the botocudos.

18. Above the creepers and ferns, from among the high branches, paroquets scream under the green leaves.

19. Monkeys, red and brown and with furry tails, are there howling and grimacing, rolled round the branches like moss.

20. The ouistitis, greedy lover of insects, watches or gambols in the sun, the locust exhausts its stridulous monotones, and the colibris chase the pollen. The bird-flies ruby-winged, the narcissus of the flowers, green coleopteras and butterflies with their blazing corselets and blue wings, all the graceful atoms in the sun's beams, fly, intermingle, rise, and fall like the sparks of a *feu d'artifice*, and shimmer, bathed in gold, in the light of the glades and distant vistas.

21. There is less noise and less luster in the mosses below, but there is a whole living, busy, animated world there, notwithstanding. The tree-trunks are peopled, the roots have their hives, the bark hides its legions, the sap trickles, there is life everywhere. Creation, incessant, universal, infinite, inexhaustible, which lives from death.

22. These are what I have found, and what I have seen in the forest: a rich and varied panorama, a sweet and powerful orchestra, a conservatory opulent in perfumes, a casket of flowers. It has given me all the joys of sense; the mind too has had its enlightenment and its enchantment.

23. This grand tree, with its straight smooth trunk, shooting up like the palm, toward the clouds—what is its fate?

24. I see it prone, naked, in the hands of the shipwright; then it rises, the shapely mast of a noble ship, carrying a flag, and the ideas which it represents, to the ends of the earth. It will hold the blessed canvas, perhaps, which shall waft us to the wished-for port of our lost country.

25. Mount, ever mount, tree of our dreams and hopes! May the gnawing worm be far from thy powerful trunk! May the lightning spare thy head!

26. How generous and fruitful is the virgin forest of southern lands! Like Cybele, her mother, she bares her breast to all. She has germs and essences, she has sap and hidden forces, for science, for art, and for labor. She shelters under her arches all that vast unknown animal kingdom, from the insect to the jaguar,

Blu-Blu Waterfall, St. Thomas

from the infusoria to the monkey. The Indian, too, finds there his shelter and his food, like the plants and the bee. But it is sufficient for itself, it renews itself with the ages, clothed like them in unfading youth. It is one of the grand, free, and sovereign beings, which remain on the earth. What is its secret? Humidity and heat, sunshine and dew.

27. What sun and dew are to the forest, science and labor are to humanity. A forest is not alone a poetic grouping, the great poem of the eyes; it is a profound system of philosophy, a revelation which promulgates one of the great laws of creation.

CHARLES RIBEYROLLES, "The Sublime in Nature."

DISTRIBUTION OF FERNS.

1. FERNS are associated with the most beautiful portions of this world's surface. The most graceful of Nature's garments, they seek to clothe, not the dull expanse of level plain, or the bare, straight side of hill or mountain. They do not grow on sandy flats, on the even margin of a sluggish river, or on the smooth and rockless lines of seacoast. Where the scorching sunrays fall unscreened upon arid earth, and where no shadows relieve the course of a far-reaching expanse of open country, no ferny growths are found. It is where Nature is in her wildest moods, and assumes her grandest aspects, or where the beauty which is spread over rock and wood and stream is of that

dreamy kind which most powerfully stirs the imagination and enthralls the soul, that ferns are found in the greatest perfection, waving their graceful fronds in response to the mountain breeze, or bending under the weight of spray drops flung upon them from the impetuous mountain torrent.

2. Ferns love to grow where the land is musical with running water; where great woods fling their shadows upon the hillside, and hang darkly over stream-crossed valleys; where rivers, wandering over the crests of towering rocks, and leaping from the sunlight, fall foaming into dark pools, bristling below with sharp points of stone, to be carried thence, in fury, down steep inclines to the sea; where for long miles the landscape undulates into heathery waves, broken by clumps of gorse on rocky mounds, sheltered by prickly hawthorn or trailing sprays of blackberry; where undulating meadows, cleft into many a sheltered hollow, roll gracefully away as far as the eye can reach; where storm-tossed waves roar upon the rugged points of a rocky coast, and echo into many a cavernous hollow moist with the perpetual droppings of percolating water; where, in short, mountain and valley or hill and glen commingle; and towering rocks or stately woods, jutting knolls and arching branches, play with sunshine and shadow, and caress the sides of running streams, whose sparkling waters give birth to soft, moist vapors.

3. Enough has been said to show that ferns delight in moist and shady places, and, thoroughly in keeping with their soft and graceful habit, they love

light and porous soils, where their roots can keep free from stagnancy. On shady slopes and modest elevations they mostly like to dwell. Fibrous peat and sand, and the spongy mold of fallen leaves, form soils in which these plants delight. Through such soils water always percolates freely; for stagnant moisture is fatal to fern life. Hence the sloping sides of a mound or hedge-bank; the crest and sides of rocky elevations; the forks of trees, where leaf-mold has accumulated; the shaded margins of running brooks or larger streams; the moist caverns in the sides of cliffs above the tide-mark; the mossy crests of islets in mid-stream; the sloping, sheltered hill-sides; even the moister hollows of the plain, and the broken depths of forest glades and forest coverts, are the sites which are most congenial to ferny forms, and which most readily adapt themselves to ferny growths.

4. It will be seen that the presence of ferns in any place assumes the pre-existence of conditions favorable to their growth. They are never found absent from an old forest. Let us inquire the reason of this, and examine into Nature's preparations for their reception. The presence of clustered trees for a long period of years gives rise to the formation of a surface soil which is composed of the decomposed remains of the crops of leaves which, in the deciduous species of trees, annually fall to the ground. Leaves upon leaves accumulating form the most perfect vegetable mold, and this, built up upon the porous subsoil, and largely intermixed with the root fibers of plants which have

sprung up and died down each year, constitutes a soil—at once rich, light, and porous—in which ferns especially delight. The sheltering canopy of trees, while it keeps out the sunlight, keeps in the moist emanations from the ground, and thus creates other conditions which are essential to fern life. Within a forest the ground is generally uneven and diversified. Banks of rock or earth are found scattered about—the former cleft into various shapes, forming hollows and crevices of various kinds—the latter mostly covered by some species of vegetation of dwarf or shrubby growth, and overarched by the taller growths of the forest. In the hollows and crevices of the rocks, and upon the top and sides of the earthy banks leaves perpetually fall and decay, and in course of time form a leafy soil, which mingles with crumbling rock or earthy granules, it may be, of sand or gravel. Upon such places fern spores drop, and find the situation suited for them by reason of its moist and sheltered position. Soil and position being congenial, the spores develop into plantlets, and these in time into full-grown ferns. The conditions which favored their early existence are maintained. The soil is annually enriched by additional deposits of leaf-mold, and, the moisture and shelter continuing, the ferns grow to maturity, and then spread their myriad atoms of reproduction, which, wafted to other rocky holes, marshy banks, and old, moist forks of trees, soon fill the forest with graceful ferny forms, covering sloping banks, waving from the crowns of pollard trunks, and draping rock and river with their feathery tresses.

5. Or take the case of a stream which flows rapidly through a mountain gorge, or along the bowlder-strewn bed of a valley. Vegetation of large growth—trees or giant shrubs—will follow the course of such a stream, for its moist channel is favorable to the development of vegetable life. The stream brings moisture; the trees or other growths bring shelter; the force of the current makes and maintains holes and fissures in its earthy or rocky bed. These are filled with leaf-mold from dropping leaves, and with sand and fibers from the carrying stream. Then Nature begins her work, and plants her smaller growths of moss, lichen, and fern on the dark, moist surfaces of earth or rock. The process of dwarf forestry commences, and slowly and surely the whole ground-plan is draped with a mantle of living green.

6. Chance, perhaps, has thrown together in mid-stream some shapeless masses of rock; the water brings down a contingent of broken branches torn from their parent stems by the force of high winds, or fallen under the process of natural decay. The jutting masses of stone arrest the woody fragments, and these in their turn catch the passing whirl of stream-borne leaves, and dam the earthy substances washed down from the banks of the stream above. A process of accumulation commences. The mass thickens and strengthens, and some bold plant starts up from its center. Others follow, and their matted roots consolidate the substance, which by degrees acquires increased consistency and becomes an islet. Among the earliest of vegetable inhabitants are the mosses and lichens, and then

the domain is appropriated as another portion of the fern world by the appearance of some representative of the moisture-loving family.

7. Again, the face of the country may be traversed by gentle risings of the ground, and intersected by hedge-banks dividing the domains of pasture or corn land and skirting a network of roads and lanes. If the soil be rich and the roadways narrow, the banks of earth or loosely built stone may be crowned by stately shrubs or trees, whose branches cross the way between and meet each other. Then upon the hedge-top, or on the hedge-bank, leaf-mold gathers, and ferny forms assemble and greet the passerby.

8. Let it be remembered, however, that the various members of this beautiful family of plants have varying predilections in the matter of soil and position. Some seek the drenching moisture of the waterfall or the dripping walls of sea-caves. Others can live and thrive in the moderate moisture of sloping banks under the shelter of shrubs or trees, while others still will grow on the open surface of an undulating plain. But, with few exceptions, ferns mostly love to be elevated, even if but slightly, above level surfaces. It is percolating moisture which they love—moisture which does not rest about their roots, but passes away immediately into the soil below. And there is a beautiful consistency in the love of these plants for sloping banks and jutting knolls, for only in such positions can they show to advantage their graceful and beautiful forms.

FRANCIS GEORGE HEATH, "The Fern World."

THE SENSITIVE-PLANT.

1. A Sensitive-Plant in a garden grew,
And the young winds fed it with silver dew,
And it opened its fan-like leaves to the light,
And closed them beneath the kisses of night.

2. And the Spring arose on the garden fair,
And the Spirit of Love fell everywhere;
And each flower and herb on Earth's dark breast
Rose from the dreams of its wintry rest.

3. But none ever trembled and panted with bliss
In the garden, the field, or the wilderness,
Like a doe in the noontide with love's sweet want,
As the companionless Sensitive-Plant.

4. The snowdrop, and then the violet,
Arose from the ground with warm rain wet,
And their breath was mixed with fresh odor sent
From the turf, like the voice and the instrument.

5. Then the pied windflowers and tulip tall,
And narcissi, the fairest among them all,
Who gaze on their eyes in the stream's recess,
Till they die of their own dear loveliness;

6. And the Naiad-like lily of the vale,
Whom youth makes so fair and passion so pale,
That the light of its tremulous bells is seen
Through their pavilions of tender green;

7. And the hyacinth purple, and white, and blue,
Which flung from its bells a sweet peal anew
Of music so delicate, soft, and intense,
It was felt like an odor within the sense;

8. And the rose like a nymph to the bath addressed,
Which unveiled the depth of her glowing breast,
Till, fold after fold, to the fainting air
The soul of her beauty and love lay bare;

9. And the wand-like lily, which lifted up,
As a Mænad, its moonlight-colored cup,
Till the fiery star, which is its eye,
Gazed through the clear dew on the tender sky;

10. And the jessamine faint, and the sweet tuberose,
The sweetest flower for scent that blows;
And all rare blossoms from every clime
Grew in that garden in perfect prime.

SHELLEY.

USES OF THE COCOA-NUT TREE.

1. IMAGINE a traveler passing through one of those countries, situated under a burning sky, where coolness and shade are so rare, and where habitations, in which to take the repose so necessary to the traveler, are only to be found at considerable distances. Panting and dispirited, the poor traveler at length per-

Gathering Cocoanuts, Lorenzo Marquez.

ceives a hut surrounded by some trees with straight erect stems, surmounted by an immense tuft of green leaves, some being upright and the others pendent, giving an agreeable and elegant aspect to the scene. Nothing else near the cabin indicates cultivated land. At this sight the spirits of the traveler revive; he collects his strength, and is soon beneath the hospitable roof. His host offers him an acidulous drink, with which he slakes his thirst; it refreshes him. When he has taken some repose, the Indian invites him to share his repast. He produces various courses, served in a brown-looking vessel, smooth and glossy; he serves also some wine of an extremely agreeable flavor. Toward the end of the repast his host offers him sweetmeats, and he is made to taste some excellent spirits.

2. The astonished traveler asks who in this desert country furnishes him with all these things. "My cocoa-nut tree," was the reply. "The drink I presented you with on your arrival was drawn from the fruit before it is ripe, and some of the nuts which contain it weigh three or four pounds. This kernel, so delicate in its flavor, is the fruit when ripe. This milk, which you find so agreeable, is drawn from the nut; this cabbage, whose flavor is so delicate, is the top of the cocoa-nut, but we rarely regale ourselves with this delicacy, for the tree from which the cabbage is cut dies soon after. This wine, with which you are so satisfied, is still furnished by the cocoa-nut tree. In order to obtain it an incision is made into the spathe of the flowers. It flows from it in a

white liquor, which is gathered in proper vessels, and we call it palm wine; exposed to the sun, it gets sour and turns to vinegar. By distillation we obtain this very good brandy which you have tasted. This sap has supplied the sugar with which these sweetmeats are made. These vessels and utensils have been made out of the shell of the nut.

3. "Nor is this all; this habitation itself I owe entirely to these invaluable trees; with their wood my cabin is constructed; their leaves, dried and plaited, form the roof; made into an umbrella, they shelter me from the sun in my walks; the clothes which cover me are woven out of the fibers of their leaves. These mats, which serve so many useful purposes, are produced by them also. The sifter which you see was ready made to my hand in that part of the tree whence the leaves issue; with these same leaves woven together we can make sails for ships. The species of fiber that envelops the nut is much preferable to tow for calking ships; it does not rot in the water, and it swells in imbibing it; it makes excellent string, and all sorts of cable and cordage. Finally, the delicate oil that has seasoned many of our dishes, and that which burns in my lamp, are expressed from the fresh kernel."

4. The stranger would listen with astonishment to the poor Indian, who having only his cocoa-nut tree, had nearly everything which was necessary for his existence. When the traveler was disposed to take his departure, his host again addressed him: "I am about to write to a friend I have in the city. May I

ask you to charge yourself with my communication?" "Yes; but will your cocoa-nut tree supply you with what you want?" "Certainly," said the Indian; "with the sawdust from the wood I made this ink, and with the leaves this parchment; in former times it was used to record all public and memorable acts."

BONIFAS-GUIZOT, "Botany for Youth."

THE BOTANIC GARDEN OF PAREDENIA.

1. IN the central province of Ceylon, 1,500 feet above the sea, lies the former capital of the island, the celebrated city of Kandy, and but a few miles distant from it Paredenia, a small town that for a brief season, five hundred years ago, likewise enjoyed the honor of being the regal residence of an ancient king. Here, in 1819, the English Government established a botanic garden, and intrusted Dr. Gardner with its management. His successor, Dr. Thwaites, the learned author of an excellent "Flora Ceylonica," for thirty years did everything in his power to raise the garden to a standard that would correspond with its peculiar climatic and local advantages. On his retirement, a few years ago, Dr. Henry Trimen was appointed director of the garden, and from this gentleman I received a cordial invitation to visit Paredenia. I accepted the kind invitation all the more readily, because I had already in Europe heard and read a great deal about the splendid collection of rare plants in the

Botanic Garden of Paredenia, and my great expectations were not disappointed. If Ceylon is in truth a paradise for the botanist, as well as for every plant-friend, then Paredenia may justly be termed the heart of this botanical Eden.

2. The entrance to the garden is through an avenue of noble India-rubber trees (*Ficus elastica*). This is the tree whose inspissated milk-sap forms the caoutchouc of commerce, and whose young plants are frequently seen in the greenhouses of our rugged north. While these India-rubber plants with us are objects of admiration when their slender stems grow to the height of the ceiling, and their few branches bear from fifty to one hundred leathery, egg-shaped leaves, here in their hot mother-country they develop into gigantic trees of the highest rank, and rival our proudest European oaks. The immense crown of many thousands of leaves covers with its mighty branches (forty to fifty feet long) the superficial surface of a stately palace, while from the base of the thick trunk extends a network of roots that frequently measures from one hundred to two hundred feet in diameter—far more than the height of the tree itself. This astounding root crown consists mostly of twenty or thirty main roots, from each of which branch as many more—all of them curving and twisting over the ground like so many gigantic serpents, for which reason the Cingalese call it the "snake-tree," and poets at various times have likened it to the snake-entwined Laocoön. The spaces between the roots form veritable closets or sentry-boxes, in some of which a man

standing upright may effectually conceal himself. Similar root-columns are developed by other large trees of different orders.

3. Scarcely had I expressed my admiration for this avenue of snake-trees, when my eyes were enchained by another wonderful sight near the garden gate. There, as if to greet the new-comer, stood a huge bouquet of palms, composed of those species indigenous to the island, and a number of foreign representatives of this noblest of tropical families; garlands of lovely creepers festooned their crowns, while their stems were ornamented with the most exquisite parasitic ferns. A similar but handsomer and more extensive group stands near the end of the main alley, and is encircled by a lovely wreath of flowering plants. Here the alley branched, the path on the left leading to a slight eminence on which stands the bungalow of the director. This enviable home is, like most Ceylonese villas, a low, one-storied structure, encircled by an airy veranda whose wide, projecting roof is supported by a row of white pillars. Roof and pillars are adorned with luxurious vines, large-flowered orchids, odorous vanilla, showy fuchsias, and other bright flowers; choice collections of flowering plants and ferns embellish the garden beds which surround the house, and above them rise the shade-dispensing crowns of India's noblest trees. Numerous gorgeous butterflies and beetles, lizards and birds animate this charming picture.

4. As the villa stands on the highest eminence in the garden, and the broad velvety lawn slopes away

from it on every side, the view from the veranda embraces a large portion of the garden with several of its most attractive tree-groups, and the belt of tall forest trees which incloses the meadow land. Beyond them rise the wooded summits of the mountain chain which encircles Paredenia valley.

5. The Mahawelli-ganga flows in a wide, semicircular sweep around the garden, and separates it from yonder chain of hills; consequently it lies on a horseshoe-shaped peninsula whose land side, where it adjoins the Kandyan valley, is effectually protected by a tall, impenetrable hedge of bamboo, thorny rattan, and other equally formidable plants. As the climate (at 1,500 feet above sea-level) is extraordinarily favorable, and the tropical heat of the sheltered valley, in conjunction with the copious rains which fall in the neighboring mountains, transform the Paredenia Garden into a natural forcing-house, it will be readily understood that the tropical flora here develops her wonderful productive power in the highest degree. My first ramble through the garden, in company with the well-informed director, convinced me that this was indeed the case; and although I had read and heard so much about the wonderful attractions of the exuberant tropical vegetation, had longed for so many years to behold it with my own eyes, the actual reality, the actual enjoyment of the fabled glories, far surpassed my highest expectations, and that, too, after I had been prepared by what I had seen in Bombay and Colombo. In the four days I spent at Paredenia I gained more information concerning the life and hab-

its of the plant world than I could have acquired at home in as many months by the most diligent botanical study. And when, two months later, I returned to the garden for a farewell visit, my delight was as great as when I first beheld its manifold attractions. I can not adequately express my gratitude for the courteous hospitality and wealth of information I received from my good friend Dr. Trimen. The seven days in his enchanting bungalow were, for me, seven veritable days of creation!

6. Vastly unlike most of the botanic gardens of Europe, whose stiff rows of beds remind one of files of soldiers, the Paredenia Garden (one hundred and fifty acres) is arranged with regard to æsthetic effect, as well as for the systematic classification of the plants. The principal tree-groups, and plants of kindred species, are tastefully distributed over grassy lawns, with pleasant paths leading from one to the other. In a more retired part of the garden are the less attractive beds for the cultivation of useful plants. Almost all the useful plants of the torrid zone (of both hemispheres) are here represented; seeds, scions, and fruits of many of them are annually distributed among the planters and gardeners on the island. Thus the garden is not only an experimental station and acclimatization garden, but it has for years conferred important practical benefits on the colonists.

7. If, among the many wonders in Paredenia Garden only a few are to be briefly noticed, then I shall begin with the celebrated giant bamboo, the astonishment and admiration of every visitor. Rambling from

the entrance gate toward the river and along its lovely bank, we see, while still at a distance, huge green bushes over one hundred feet high, and as many broad, which spread their plumed heads—like the feather brushes of giants—high above the river and the road, casting delightful shadows over both. Approaching nearer we see that this stupendous mass of verdure is composed of numerous (from eighty to one hundred) slender stems from one to two feet thick, which have sprung from a common root, and bear, on delicate, nodding branches dense clusters of the daintiest leaves. And these gigantic trees are nothing but grasses! Like all grass-stalks these prodigious tubes are jointed; but the sheaf which, in the delicate species, is a thin small scale at the base of the leaf is, in this bamboo giant, a firm woody partition that, without further preparation, might serve as a shield for the breast of a vigorous man. A child of three years might hide in one of the joints! As is well known, the bamboo belongs to the useful plants of the tropics; but to fully describe the manifold uses to which these tree-grasses—as well as the palms—are turned to account by the natives would fill a whole volume.

8. Next to the bamboos—or, indeed, before them—come the palms. Besides the orders indigenous to the island, we find here a number of palms that are natives of the mainland of India, the Sunda Islands, Australia, and tropical America—as, for instance, the *Livistonia chinensis*, with its huge crown of fan-shaped leaves; the celebrated Lodoicea from the Seychelles, with its colossal fans; the Elœis, or oil-

palm of Guinea, with its long, plume-like foliage; the famous Mauritia from Brazil; the lofty Areodoxa, or king's palm, from Havana, etc. Of the latter I admired and sketched, on Teneriffe (1866), a splendid specimen, and was therefore not a little surprised and delighted to behold here a whole avenue of the stately trees. No less interesting were splendid groups of thorny climbing palms or rattans (*Calamus*) with delicate, vibrating leaves; their slender but firm and elastic stems climb to the tops of the highest trees, often attaining a length of three or four hundred feet. They belong to the longest of all land plants.

9. One of the most attractive parts of Paredenia is the fern garden. In the dense shade of tall trees along the cool banks of a murmuring brook is assembled a company of small and large, delicate and vigorous, herbaceous and arboreous ferns, such as it would be impossible to imagine any more charming and agreeable. The entire charm of form which distinguishes the dainty feathery foliage of our native ferns is here displayed in an endless variety of different species, from the simplest to the most complex; and while some of the pretty little dwarf ferns might easily be confounded with dainty mosses, the giant tree-ferns, whose slim, black stems bear a lovely crown of feathery leaves, attain the proud height of the palm.

10. Like the ferns, the fern-palms, or *Cycadeæ*, as well as the dainty selanginella and lycopodia families, are represented in Paredenia by choice collections of the most interesting species, from the most minute,

moss-like forms to the robust shrub sorts that almost remind one of the extinct tree-lycopodia of the Stone-coal period. Indeed, many plant-groups in this garden recall to mind the fossil flora so admirably portrayed by Unger in his views from an antediluvian world. If, in conclusion, but two more plant orders, which are of peculiar interest to me, are to be introduced to your notice, then the first shall be the lianas, and the second the banyans. Although creeping and climbing plants are abundant everywhere on the island, the Paredenia Garden contains several splendid examples, the like of which are rarely found; for instance, colossal vines of the Vitis, Cissus, Purtada, Bignonia, Ficus, etc. Also the banyans, and several kindred fig-trees (*Ficus galaxifera*, etc.), are the finest, most magnificent tree-forms I saw on Ceylon.

ERNST HAECKEL, "India and Ceylon."

THE BAMBOO.

1. NEXT to the palms, the bamboo tribe claims precedence among the plants of India, both by its variety of form and its great numbers. According to Zollinger's table of the different Javanese species, certain kinds which grow to the height of more than ninety feet, individual examples one hundred and thirty feet high have been measured, but the average height varies between twenty and fifty feet. The prickly bamboo does not grow so high, but twines closely round the

nearest stem, and forms an impenetrable jungle or bush. The thickness of the stem varies between about twelve inches and the tenth of an inch. The color of the leaves shades from bright green to a pale yellow tint. The climbing lianas, for instance, the Dinochloa, which resembles the rotang palm in its circular formation, hangs down its graceful branches tipped with a feathery tuft of leaves. The slenderer forms put out fresh growth at the summit of the stem, which hardens by the amount of silica which it contains, and is covered with joints from which short branches tipped with leaves are put forth all the way down the stem. When they are joined together, they shoot upward like a gigantic cane bush, and at last bend down on all sides in gently curving arches to the ground. Their social life, the close disposition of the stems which sway with a soft rustling murmur at every breath of wind, the dead leaves which cover every inch of the soil, exclude all other kinds of vegetation from the interior of a bamboo jungle. When the water supply is abundant, the growth of the bamboo increases with almost miraculous speed, so that in a few days the stem gains several feet, and lengthens as it were visibly before the eye; it is nevertheless able to support the interruption caused by long seasons of drought, and is therefore equally at home in the swampy forest as in the parched savannas. The largest bamboo indigenous to Siam develops its sheaf of stem of eighty-two to ninety-eight feet high in the space of three or four months, and then begins to fade in the dry season, and sinks to the

ground. A tropical climate is not an absolute necessity for the growth of the bamboo, some of which are seen in Sikkim at a height reaching to the limit of tree growth.

2. The numberless ways in which the bamboo enters into the national life of the countries where it is found have attracted the attention of every traveler. The longer he sojourns in Eastern lands, the greater is his astonishment at the myriad purposes to which certain plants are applied by the Orientals. In the first rank among these necessaries of Eastern life come the cocoa-palm and the bamboo. The Javanese builds his house of bamboo; every article of household furniture is made of the same material; he lights a fire of bamboo, and over it he cooks his rice in a bamboo dish, which is charred but not destroyed in the process. Very possibly the dish may contain, instead of rice, some young shoots of the bamboo, which form a tender and succulent vegetable. Sometimes no other material is seen in a whole village; the fairy-like palisading which incloses it, and the gates themselves, are all made of bamboo.

3. The prickly bamboo, a species which grows to the height of thirty-nine feet, in thick bush branches covered with formidable thorns, forms a rampart hardly to be broken through, even by the aid of artillery; so that the Dutch, taught by their experience in Sumatra, always plant it round their fortresses. The sportsman and the soldier use it for lances, arrows, and a blow-pipe, by means of which poisoned arrows are shot. It is constantly employed to form bridges,

and it provides the fisherman with incomparable rafts, masts, and creels. In China nearly all the paper is manufactured from bamboo, even paper used in Europe for art printing. The canes in use among us are bamboos, while the cane employed for chairs, etc., is obtained from palms, natives of the East Indies, especially the *Calamus rotang* and *Calamus verus*. To add one more use to which the inexhaustible bamboo may be put, we may mention that a wedge-shaped piece of the cane cut the cross way of the stem, so that the sharp edge is formed of the outer silicious stratum, makes a knife good enough to be even used in surgical operations.

ANONYMOUS, "Wonders in Living Nature."

MARINE PLANTS.

1. THE dry land develops the most exuberant vegetation on the lowest grounds, the plains, and deep valleys, and the size and multiplicity of plants gradually diminish as we ascend the higher mountain regions, until at last merely naked or snow-covered rocks raise their barren pinnacles to the skies; but the contrary takes place in the realms of ocean, for here the greater depths are completely denuded of vegetation, and it is only within six hundred or eight hundred feet from the surface that the calcareous nullipores begin to cover the sea-bottom, as mosses and lichens clothe the lofty mountain-tops. Gradually corallines

and a few algæ associate with them, until finally about eighty or one hundred feet from the surface begins the rich vegetable zone which encircles the margin of the sea. The plants of which it is composed do not indeed attain the same high degree of development as those of the dry land, being deprived of the beauties of flower and fruit; but as the earth at different heights and latitudes constantly changes her verdant robe, and raises our highest admiration by the endless diversity of her ornaments, thus also the forms of the sea-plants change, whether we descend from the brink of ocean to a greater depth, or wander along the coast from one sea to another; and their delicate fronds are as remarkable for beauty of color and elegance of outline as the leaves of terrestrial vegetation.

2. The difference of the mediums in which land- and sea-plants exist naturally requires a different mode of nourishment, the former principally using their roots to extract from a varying soil the substances necessary for their perfect growth, while the latter absorb nourishment through their entire surface from the surrounding waters, and use their roots chiefly as holdfasts.

3. The constituent parts of the soil are of the greatest importance to land-plants, to whose organization they are made to contribute; while to the sea-plant it is generally indifferent whether the ground to which it is attached be granite, chalk, slate, or sandstone, provided only its roots find a safe anchorage against the unruly waters.

4. Flat rocky coasts, not too much exposed to the

swell of the waves, and interspersed with deep pools in which the water is constantly retained, are thus the favorite abode of most algæ, while a loose sandy sea-bottom is generally as poor in vegetation as the Arabian desert.

5. But even on sandy shores extensive submarine meadows are frequently formed by the grass wrack (*Zostera marina*), whose creeping stems, rooting at the joints and extending to a considerable depth in the sand, are admirably adapted for securing a firm position on the loose ground. Its long ribbon-like leaves, of a brilliant and glossy green, wave freely in the water, and afford shelter and nourishment to numerous marine animals and plants. In the tropical seas it forms the submarine meadows on which the turtles graze, and in the north of Europe it is used for the manufacture of cheap bedding. It also furnishes an excellent material for packing brittle ware.

6. Sea-weeds are usually classed in three great groups—green, olive-colored, and red; and these again are subdivided into numerous families, genera, and species.

7. On the British coast alone about four hundred different species are found, and hence we may form some idea of the riches of the submarine flora. Thousands of algæ are known and classified, but no doubt as many more at least still wait for their botanical names, and have never yet been seen by human eye.

8. The green sea-weeds, or *Chlorospermeæ*, generally occur near high-water mark, and love to lead an amphibious life, half in the air and half in salt-water.

The delicate *Enteromorphæ*, similar to threads of fine silk, and the broad brilliant *Ulvæ*, which frequently cover the smooth bowlders with a glossy vesture of lively green, belong to this class. Many of them are remarkable for their wide geographical distribution. Thus the *Ulva latissima* and the *Enteromorpha compressa* of our shores thrive also in the cold waters of the Arctic Sea, fringe the shores of the tropical ocean, and project into the southern hemisphere as far as the desolate head-lands of Tierra del Fuego. But few animals or plants possess so pliable a nature, and such adaptability to the most various climates.

9. The olive-colored group of sea-weeds, or *Melanospermeæ*, plays a much more considerable part in the economy of the ocean. The common fuci, which on the ebbing of the tide impart to the shore cliffs their peculiar dingy color, belong to this class; as well as the mighty *Laminariæ*, which, about the level of ordinary low water and one or two fathoms below that limit, fringe the rocky shore with a broad belt of luxuriant vegetation.

10. The first olive-colored sea-weed we meet with on the receding of the flood is the small and slender *Fucus canaliculatus*, easily known by its narrow grooved stems and branches and the absence of air-vessels. Then follows *Fucus nodosus*, a large species, with tough thong-like stems, expanding at intervals into knob-like air-vessels, and covered in winter and spring with bright yellow berries. Along with it we find the gregarious *Fucus vesiculosus*, with its forked leaf traversed by a midrib, and covered with numer-

ous air-vessels situated in pairs at each side of the rib. Finally, about the level of half-tide, a fourth species of fucus appears, *Fucus serratus*, distinguished from all the rest by its toothed margin and the absence of air-vessels.

11. These four species generally occupy the littoral zone of our sea-girt isle, being found in greatest abundance on flat, rocky shores, particularly on the western coasts of Scotland and Ireland, where they used formerly to be burned in large quantities for the manufacture of kelp or carbonate of soda, which is now obtained by a less expensive process. In Orcadia alone more than twenty thousand persons were employed during the whole summer in the collection and incineration of sea-weeds, a valuable resource for the poverty-stricken islanders, of which they have been deprived by the progress of chemical science.

12. The fuci are, however, still largely used, either burned or in a fermented state, as a valuable manure for green crops. Thus every year several small vessels are sent from Jersey to the coast of Brittany to fetch cargoes of sea-weeds for the farmers of that island.

13. The largest of indigenous sea-weeds are the *Laminaria saccharina* and *digitata*, or the sugary and fingered oar-weeds. Their stout woody stems and broad, tough, glossy leaves of dark olive-green, often twelve or fourteen feet long, must be familiar to every one who has sojourned on the coast. When gliding over their submerged groves in a boat, their great fronds floating like streamers in the water afford

the interesting spectacle of a dense submarine thicket, through whose palm-like tops the fishes swim in and out, emulating in activity the birds of our forests.

14. But our native oar-weeds, large as they seem with regard to the other fuci among which they grow, are mere pygmies when compared with the gigantic species which occur in the colder seas.

15. None of the members of this family grow in the tropical waters, but they extend to the utmost polar limits, and seem to increase in size and multiplicity of form as they advance to the higher latitudes. The northern hemisphere has generally different genera from the southern. To the former belong the gigantic Alarias with their often forty feet long and several feet broad fronds, the singularly perforated Thalassophyta, and the far-spreading Nereocystis, which is only found in the Northern Pacific; while the genera *Macrocystis* and *Lessonia* are denizens of the Southern Ocean.

G. Hartwig, "The Sea and its Living Wonders."

DIFFUSION OF PLANTS.

1. As the earth does not bring forth in every place all the plants which could live upon its surface, so the several kinds of animals have a definite and probably for the most part a very limited territory allotted to them for their reproduction; but animals and plants have ventured to overstep these narrow limits, and

win for themselves large tracts of the earth's surface outside the boundaries of their original birthplace.

2. Chained to its clod of earth, and incapable of altering its locality at will, the plant is apparently helpless; but it has powerful allies, of which the most important are wind, water, and animals. For the present we will not speak of culture and acclimatization, by which men foster and promote the growth of certain foreign plants. Marvelous are the contrivances by which Nature herself provides for the wide distribution of seeds. Sometimes the fruit, sometimes the seeds, are furnished with wings or hairy crowns, by which the wind may carry them far and wide. We have only to remember these contrivances, as shown in the dandelion, elm, poplar, and maple. Sometimes the plants open with an elastic movement, and scatter their own seed, as in the case of balsams, wood-sorrel, and a kind of cucumber (*Ecballium officinale*). We must not forget to mention the tenacity of life possessed by the seed.

3. In the year 1176, at Linz on the Rhine, some of the *Crepis pulchra*, a flower extremely rare in Germany, and which had certainly not been seen at Linz within the last twenty years, was found in some earth which had been dug out of the church in the preceding year; so that the seed must have slept for many years in the ground, and yet retained its germinating power. In a similar manner there appeared suddenly near the old mines of Mount Laurion, in Attica, the plants *Glaucium serpieri* and *Silene juvenalis*—plants entirely unknown, or at least never seen in that neigh-

borhood. These seeds had lain buried for an indefinite length of time three yards below the surface, and were brought to light by the workmen who were preparing to extend the mines. This long sleep of the seeds, a sleep which it is thought may last for centuries, explains how it is that tunnelings and railway cuttings are often the scenes of valuable discoveries of new and rare plants, the seed buried for years in the earth being unintentionally and unconsciously dug out by the hand of man.

4. Other plants follow the courses of rivers and running streams, by which their seeds are carried down into suitable places. Thus the *Œnothera biennis*, a native of Virginia, is said to have reached Padua in 1612, and spread thence throughout Europe; and this flower is much more abundant on the shores of the middle and lower Rhine than in the adjoining sandy plains, which are equally suited for its growth. Another example is given by the *Collomia grandiflora*, a herb belonging to North America, which was suddenly found in the year 1855 on the banks of the Ahr, near Ahrweiler. It is not known how it reached the spot, but in 1857 it was found already at the mouth of the Ahr, and in 1862 on the banks of the Rhine, near Bonn; so that in the course of seven years it had spread along forty miles of the river banks, notwithstanding the unwearied efforts of the students of Bonn to uproot it and transfer it by handfuls to their herbaria.

5. Animals are of great use in furthering the distribution of plants. Very many fruits and seeds are

carried bodily away by being caught and fastened with thorns and brambles in the fleece of woolly animals. The seeds of many Australian plants, for instance, have been carried to Europe in the fleeces of Australian sheep. Many animals eat berries without destroying the seed, which passes through them uninjured. The seed so sown is so far from having lessened its powers of fructification that, in the opinion of Altum, it must have been specially intended to be prepared for sowing in that manner. It is known also that, to the great annoyance of the Dutch Trading Company, the pigeons who fed on the valuable Muscat nuts in the Moluccas transplanted it with increased powers of germination, increased by its passage through their bodies, although it is said to have previously defied every method of artificial cultivation. The seeds of the white thorn do not germinate until they have lain buried in the earth for a whole year; but if turkeys are fed with the seed in autumn, and the birds' manure sown, the seeds will come up in the following spring.

6. There is no doubt, then, that many plants have been distributed in this manner by the aid of birds. While some plants spread abroad to almost incredible distances in the course of time, others seem bound to one narrow home; for instance, a member of the palm tribe (*Lodoicea sechellarum*), which grows only in two of the Seychelle Islands. Its fruits are often carried by the ocean currents to the Maldives, where they are known as Maldive nuts, and their great size and mysterious appearance on the shore gave rise to number-

less fantastic suppositions until their true home was discovered. One of the most effectual barriers against the complete and wholesale intermingling of plants is the sea, for although its currents tend to spread them abroad, its great extent hinders their passage to the opposite shore. The greater the distance between two coasts the more sharply sundered is their vegetation. Next to the sea, the great desert wastes, such as that of Sahara, act as barriers, and the inaccessible forests of tropical America divide the floras of the adjoining countries. In ordinary cases, however, the changes of climate are sufficient to preserve the distinct character of the natural flora, and the high peaks of mountains, like those of the European Alps, form a limit to the exchange of neighboring vegetation.

ANONYMOUS, "Wonders in Living Nature."

AUTUMN.

1. WITH what a glory comes and goes the year!
   The buds of spring, those beautiful harbingers
   Of sunny skies and cloudless times, enjoy
   Life's newness, and earth's garniture spread out;
   And when the silver habit of the clouds
   Comes down upon the autumn sun, and with
   A sober gladness the old year takes up
   His bright inheritance of golden fruits,
   A pomp and pageant fill the splendid scene.

The Breadfruit Tree.

2. There is a beautiful spirit breathing now
Its mellow richness on the clustered trees,
And from a beaker full of richest dyes,
Pouring new glory on the autumn woods,
And dipping in warm light the pillared clouds.

3. Oh, what a glory doth this world put on
For him who with a fervent heart goes forth
Under the bright and glorious sky, and looks
On duties well performed, and days well spent!
For him the wind, ay, and the yellow leaves,
Shall have a voice, and give him eloquent teachings.
He shall so hear the solemn hymn that Death
Has lifted up for all, that he shall go
To his long resting-place without a tear.

LONGFELLOW.

THE BREAD-FRUIT-TREE.

1. AMONG the examples which in a special degree attest the watchful care of Providence, we have to mention that of the bread-tree, discovered in the isles of Oceania. This invaluable tree belongs to the genus *Artocarpus*, of the fig family. The leaves in this family are simple, plain, or serrated, and the flowers very small and imperfect, some having no corolla, and others no calyx, but all appearing alike upon the same tree at the extremities of the branches.

2. The true bread-tree has indented or serrated leaves. We say the true bread-tree, for this genus embraces many other species, which, in spite of a very remarkable organization, do not possess the properties of the one we have mentioned. Thus there is an *Artocarpus incisa*, with small leaves and flowers, but bearing fruits which are, perhaps, the largest borne by any tree on earth. These round fruits are sometimes so large that a man can not lift them! The kernels are eaten, roasted like chestnuts, but they are not easily digestible. Then there is the Jack (*Artocarpus integrifolia*), of the Indian Archipelago, with a huge trunk, and dense foliage on the broad-branching summit, while the fruit measures eighteen inches by fifteen. Travelers are not agreed as to the merits of the latter. Rheede says they have an agreeable taste and odor, but Commerson could not summon courage even to put a morsel of it in his mouth. "Tastes differ," but it seems difficult to explain such contradictory opinions, unless it should be that these travelers speak of such trees as certain critics are said to judge of works which they have never seen. A third species is the *Artocarpus hirsuta*, the tallest of the genus. Its wood is used in carpentry and in boat-building. The Indians hollow out the trunk to make their *piraguas*, some of which measure eighty feet in length by nine in width, and thus enable them to make long ocean voyages.

3. We return to the true bread-fruit-tree. The discoveries in Oceania have rendered it celebrated, and special expeditions have been undertaken for the

purpose of obtaining roots for transplantation to different parts of the Old and New World. We shall presently notice the most remarkable of these expeditions. The following are the distinctive characteristics of this tree: The trunk is straight, as thick as a man's body, and rises in a gentle spiral to the height of about forty feet. Its large round top covers with its shadow a space thirty feet in diameter. The wood is yellowish, soft, and light; the leaves, one and a half feet long and one foot wide, large and permeated with seven or eight lobes, a form which characterizes this species. The same branch bears male and female flowers. The bread obtained from the tree is its globular fruit, larger than a child's head, weighing three to four pounds, rough on the outside, and covered with hair. The thick green rind incloses a pulp, which, during the month that precedes maturity, is white, farinaceous, and slightly fibrous; but when ripe, changes in color and consistency, and becomes yellow and succulent or gelatinous. The island of Otaheite abounds in the best kind of these trees, which bear fruit without seed; the other islands of Oceanica produce varieties of less valuable bread-fruit, containing angular seeds almost as large as chestnuts.

4. The fruit of this tree ripens during eight consecutive months in the year. The islanders live upon it, as we do upon our manufactured bread; it is their main food, and Nature, as we see, furnishes it to them without their being put to the trouble of cultivating the ground, of sowing, reaping, thrashing, grinding, or baking. To have their "fresh bread" they choose

the time when the pulp is farinaceous, which they can tell by the green color of the rind. The necessary preparation "for the table" is accomplished by cutting them in thick slices and cooking them upon a charcoal fire; when ready, each "loaf" weighs about a pound. They are sometimes also placed upon a heated oven, as we do with pastry, and left there until the rind begins to blacken. Then the burnt part is scraped clean, as your toast, and the interior is white, ready to be eaten, tender as the crumbs of French rolls, but little differing in taste from wheaten bread, except only a slight flavor suggestive of the inside of an artichoke. As the natives want bread throughout the whole year, they take advantage of the time when the fruits are abundant, and prepare from the pulp of the surplus fruit a paste which, after being fermented, can be kept a long time without turning sour. During the four months when the trees do not yield, the natives live upon this preparation.

5. The expedition to which we referred was that made by Captain Bligh, sent in search of the bread-tree of Otaheite for the purpose of introducing it into the tropical colonies of Great Britain to furnish food for the slaves. The narratives of Cook and other explorers had encouraged the highest expectations of the benefits which would result from the culture of the bread-fruit-tree. The English colonists having entreated their government to obtain for them this wonderful tree, a vessel specially fitted for the purpose was got ready and placed under the command of

Bligh, then only a lieutenant, but afterward an admiral. The selection of the commander was judicious, for Bligh had accompanied Cook in his voyages, and given on many occasions proof of his talents and his gallantry. Leaving England in 1787, the expedition arrived in six months at Otaheite. The islanders received them hospitably; more than a thousand plants were put in pots and boxes and taken on board, with a sufficient quantity of fresh water to keep them alive, and five months afterward the precious cargo was floating toward its destination. But, in spite of all the happy auspices under which the return voyage was begun, it had an unfortunate ending. It furnished one of those examples, happily rare, of the revolt of a crew and the desperate position of a captain left to the mercy of the mutineers in the midst of the silent ocean. Twenty-two days after they had left Otaheite the greater part of the crew, having joined in a most cowardly plot, seized Bligh during the night and placed him with the eighteen that remained faithful to him in a long boat with some provisions and instruments, and, leaving them alone in the middle of the ocean, sailed off and were soon out of sight. Bligh and his companions bore up with superhuman courage in the midst of their fatigue and sufferings; only one succumbed. They arrived at the island of Timor, after having sailed the distance of thirty-six hundred nautical miles in the longboat. The Dutch governor received them kindly, and soon twelve of them were able to take passage to Ireland. Bligh obtained justice in England; he was immedi-

ately promoted to the rank of captain and placed in charge of a new and larger expedition. This time he succeeded completely, and two years after the two vessels of the expedition landed in the British West Indies, having on board twelve hundred plants of the bread-fruit-tree, and without having lost a single man of either of the crews.

6. The slaves of the West Indies did not show as much alacrity in making use of the fruit as had been expected, preferring their familiar food, the banana; on the other hand, the Europeans accepted it with great pleasure. It ought to be stated, however, that the slaves ate the fruit without having previously prepared it, while the Europeans cooked it according to the best receipts of English writers.

7. The old people of Otaheite attribute the origin of the bread-fruit-tree to an incident which is embodied in a touching legend. At a time of great scarcity, a father assembled his numerous children upon the mountains and said to them: "You will inter me in this place; but you will find me again on the morrow." The children obeyed, and, coming on the following day as they had been commanded, they were much surprised to see that the body of their father had been transformed into a great tree. His toes had stretched out to form the roots; his powerful and robust body had furnished the trunk; his outstretched arms were changed into branches, and his hands into leaves. His bald head finally had disappeared, and a delicious fruit was found in its place.

8. This legend recalls the seventh circle of the Inferno of Dante, where the souls who had been violent upon earth are seen changed into living trees, while their limbs writhe and twist like the branches of dead trees. But we prefer the simple legend of the primitive isles to the gloomy imagination of the great Italian. The poet speaks of the dead; the islanders appeal to the living.

FULGENCE MARION, "The Wonders of Vegetation."

ON THE USES OF PLANTS.

1. How many important and varied services are rendered to us by plants! Either directly or indirectly, all animals are nourished by plants; indeed, there is an immense number of animated beings that eat nothing but vegetable substances, and those that feed upon meat would not find sufficient food, unless they devoured each other, without destroying those that are maintained on vegetable food exclusively. There is scarcely a plant that does not nourish some animal; almost all insects, for example, live either in the perfect or in the larva state, at the expense of the plant upon which they are habitually found; and even in the highest classes of the animal kingdom the number of phytivorous species is immense, for the quadrumana, the gnawers, the pachyderms, and the ruminants all observe a vegetable diet; and man himself derives most of his food from the vegetable kingdom.

2. Among the most important alimentary plants, the first are the cereals. Under this name we designate plants of the family of grasses, which afford nourishment to man and most domestic animals; namely, wheat, rye, barley, oats, maize, and rice. There is in the interior of their seed, between the spermoderm and the embryo, a considerable deposit of amylaceous matter, designed to nourish the young plant, and designated by botanists under the name of albumen or perisperm; it is this matter we use for food. The perisperm of the cereals, and consequently the flour obtained by grinding them, is essentially composed of fecula or starch, ordinarily mixed with a certain quantity of a substance named gluten, which considerably resembles animal matter. Wheat flour contains more gluten than any other, and for this reason it makes better bread and is more nutritious; rye also contains it, but there is none in rice, oats, etc.

3. Other plants also furnish abundance of fecula, but not from the same part as in those mentioned; sometimes it is in the cotyledons of the seed, sometimes in tubercles, and at other times in the very substance of the stems or roots; thus, peas and beans and some other plants of the family of *Leguminosæ* furnish edible seeds, the cotyledons of which contain the same as the albumen of the cereals—a great deal of fecula and a certain quantity of gluten mixed with sugar and some other matters. Whatever part this fecula may occupy, it in general constitutes, as in the pericarp of the cereals, depositories of nutritive matter for the nourishment of the young plant or of new

shoots. The tubers of the potato owe their nutritious qualities to the quantity of fecula they contain; the same is true of batatas (the Spanish or sweet potato), a species of convolvulus, originally from India, which is now cultivated in all warm regions in the world. The species of fecula, known under the name of cassava or tapioca, of which great use is made in the West Indies, is derived from the root of the manioc, a plant of the family of *Euphorbiaceæ*, which also contains a very poisonous juice that is separated by means of water. Sago is another species of fecula obtained from the stem of a palm, and salep is also a fecula obtained from the stems of a monocotyledonous plant of the family of *Orchideæ*.

4. The most esteemed of our fruits, the majority of them at least, are furnished by the family of *Rosaceæ*; for example, apples, pears, plums, cherries, peaches, apricots, strawberries, raspberries; and to complete the list of fruit trees we must not omit the mention of some species of the family of *Ampelideæ* and the family of *Aurantiaceæ*; namely, the vine, the orange, and the citron.

5. Plants furnish us not only with wholesome and agreeable food, but also substances which are of the greatest utility in the manufacture of clothing and in the construction of our dwellings. Hemp, flax, and cotton yield us long, flexible filaments, which constitute excellent materials for spinning and weaving; and our forest trees, almost all of which belong to the family of *Cupuliferæ*, or that of the *Coniferæ*, furnish abundance of wood for building our houses and ships,

as well as for the manufacture of furniture and instruments of various kinds.

6. Ornamental plants which decorate our gardens and conservatories are very numerous; they are furnished by very various families, in the front rank of which we may place the *Rosaceæ*, because it has for its type one of our most beautiful flowers, the rose. Many species and varieties of rose-trees are known, and almost all of them may be cultivated in the open air in our climate; they flourish best in a light soil and partial exposure to the sun. In the wild state they have but five petals, in the midst of which we observe a great number of stamens; but cultivation has transformed most of these latter organs into petals, and enhanced the beauty of the flowers. The dahlia, which was for some years so rare, but now everywhere met in gardens, belongs to the family of *Synantherœ*; this beautiful herbaceous plant has a perennial root composed of bundles of horizontal, oblong tubercles, from which rises a cylindrical, branching stem, bearing opposite leaves and large flowers, which appear from the end of July till the approach of frost. The dahlia may be multiplied by its seeds or by the division of its roots. The genus *Aster*, which comprises a great number of beautiful autumnal flowers, including the Queen Margaret, which was imported from China into Europe about a hundred years ago, also belongs to the family of *Synantherœ*.

7. While a great many plants afford to man wholesome and abundant food, others are violent poisons to him, though very many even of the latter are useful,

because when prudently administered they constitute powerful medicines. A great number of plants of the family of *Solaneæ* are of this kind; for example, belladonna, henbane, stramonium, tobacco; some species of the family of *Papaveraceæ*, such as the poppies; and hemlock, which belongs to the *Umbelliferæ*, etc. In our citation of poisonous plants we must not omit the mushrooms.

W. S. W. RUSCHENBERGER, "Elements of Botany."

SOME WONDERFUL GARDENS.

1. THE first thing man did when he was placed on this earth was to keep a garden. And although he proved an unfaithful gardener in this instance, it would seem that his taste for horticulture has always remained a prominent passion. Whether the products were objects of utility or beauty, he sought for the most perfect method of tilling the earth, and from the earliest times of civilization or national refinement gardening was a practiced art. The story of that first Eden seems to have haunted the imaginations of men, and legends of various forms have come down of that primeval home of the race. The Greek poets celebrated the gardens of the Hesperides, which they located near the Atlas Mountains in the Barbary States. In it were orchards of trees that bore golden apples, which were guarded by a sleepless dragon with a hundred heads. The garden was walled in with

brazen gates, and was under the special protection of Juno, the queen of heaven. It was one of the twelve labors of Hercules to secure these golden apples, an exploit that he performed by putting the hundred-headed dragon to sleep.

2. Almost as celebrated in Greek story were the gardens of the Phæacian Prince Alcinous at Scheria, whose charms are related by Homer in Book Seventh of the "Odyssey" in some of his most exquisite hexameters. These gardens occupied about four acres of ground, and were fenced with a hedge or green inclosure. Every fruit and flower known to the Greeks bloomed and ripened in that favored retreat. To Ulysses, on his arrival at the palace of the Phæacian king, the gardens seemed like paradise. Two plenteous fountains irrigated the grounds, and the poet glows rapturously over its tossing fruit-laden boughs and its summery, shady bowers.

3. Among other famous Greek gardens were those of the Phrygian Prince Midas in Macedonia, celebrated for their roses with a hundred leaves, which Xerxes visited upon his invasion of Greece; and those of the Ilissus, at Athens, founded by Pisistratus 540 B. C., which were the first public gardens that we read of among the ancients.

4. Perhaps the most wonderful of all the wonderful gardens of the world were the hanging gardens of Babylon, built by Nebuchadnezzar. He reigned six hundred years before our Christian era, and was the greatest monarch and builder of his time. He erected grand public works at his capital, which be-

came wonders of the world, and he indulged in some no less costly private expenditures. His wife, Queen Amyntis, was a Median princess, and sighed for her native mountains amid the flatness of the Babylonian plain, the greatest in the ancient world. To gratify her, Nebuchadnezzar constructed the famous gardens, which were not "hanging gardens" at all, but rather an elevated paradise. Arches were raised on arches in continued series until they overtopped the walls of Babylon, the height of two hundred cubits, and stairways led from terrace to terrace. The whole structure of masonry was overlaid with soil sufficient to nourish the largest trees, which, by means of hydraulic engines, were supplied from the river with abundant moisture. In the midst of these groves stood the royal winter residence; for a retreat which, in other climates, would be most suitable for a summer habitation, was here reserved for those cooler months in which alone man can live in the open air. This first great work of landscape gardening which history describes comprised a charming variety of hills and forests, rivers, cascades, and fountains, and was adorned with the loveliest flowers the East could produce.

5. The Persians laid out extensive tracts of lands, called paradises, diversified with streams, groves, and grottoes, and beautified with every object of art. They reduced gardening to a science which was the envy even of the Greeks. The gardens of the great satrap Tisaphernes at Sardis excited the admiration of the Spartan Lysander, laid out with the most magnifi-

cent taste and adorned with all the plants and flowers of Orient lands. Mithridates, of Pontus, copying from his Persian ancestors, exhibited a horticultural passion, and was himself an adept at gardening. Lucullus, the conqueror of Mithridates, carried some of the Pontine king's ideas to Italy, ornamenting his own grounds with the fanciful establishment of the Persian to such a degree that his friends the Stoics called him "Xerxes in a gown." It is well to remember, perhaps, that it is to Lucullus that we owe the introduction of the cherry-tree into the lands of the West.

6. The Chinese have from a remote antiquity exhibited a marvelous skill in the laying out of gardens and pleasure grounds. Chinese horticulture in many respects can not be surpassed by that of the most civilized nation of to-day. The imperial gardens are said to be exquisite creations of the artist's and the gardener's art. Those of the Emperor Kien-Long, at Zhehol, present the most magnificent specimens of the Chinese style to be found in the empire. Zhehol is a small town in Tartary, and is the summer residence of the court. The palace and gardens are situated in a romantic valley, on the banks of a fine river, overhung by rugged mountains. The grounds are exquisitely laid out, and adorned with as many as fifty handsome pavilions, magnificently furnished, each containing a state room with a throne in it, and some of them having a large banqueting hall where entertainments are given on special occasions to the great mandarins of the court. Among the ornaments of these beautiful pleasure grounds are small transparent

lakes filled with gold and silver fishes, and a broad canal on which are several islands adorned with pagodas and summer-houses of various forms, sheltered by groves of trees and fragrant shrubs. All Chinese buildings of this description are highly decorated, and generally bear some resemblance to a tent, which is evidently the model from which the architecture of China was originally designed. The gilded pagodas and temples rising among the green trees, the flashing of fountains, and the flapping of countless sails on the canals combine to make this celestial paradise a garden of delight.

7. A flavor of Oriental romance is connected with the gardens of Shalimar, celebrated in Moore's "Lalla Rookh." There was never a more splendid empire than that of the Moguls at Delhi, and of all Moguls no prince was more fond of luxurious pleasures than the Emperor Shah Jehan. Every summer he passed several months in the lovely vale of Cashmere, where, with music, dancing, feasting, and excursions by land and water, he beguiled the time in a constant succession of varied enjoyments. In this favorite retreat he laid out the gardens so famous in song and story. No expense was spared in the lavish embellishment of these grounds. The gardens were intersected by canals, all flowing from a fairy lake in the center, and erected on arches; over these were several elegant saloons, to which the ladies of the court resorted to take sherbet, coffee, and other refreshments. Here the radiant, dark-eyed Moslems wandered with their turbaned lords among the bending trees, or rowed

upon the fairy lake amid countless rose leaves, while the fragrant bowers echoed to the music of harp and dulcimer and the soft voices of graceful dancing girls. The once beautiful gardens have gone to decay like most other monuments of the former wealth and grandeur of Hindoostan, but the memories of the charming Mogul princesses, Noor Mahal, Moomtasee, and Lalla Rookh, still haunt the place, and Moore's musical lines recall the vanished magnificence:

"Who has not heard of the vale of Cashmere,
With its roses the fairest that earth ever gave,
Its temples and grottoes and fountains as clear
As the love-lighted eyes that hang over their wave!"

8. Famous in English history are the gardens of Woodstock, where Henry II kept his Fair Rosamond, and where the jealous and cruel Queen Eleanor found her beautiful rival and forced her to take her choice of death either from the poisoned chalice or the jeweled dagger. Near London were the gardens of the Temple, where, according to tradition, the famous dispute took place between Somerset and York in the wars of the Roses, the latter crying in his hot rivalry:

"Let him who is a true-born gentleman
And stands upon the honor of his birth,
If he supposes I have pleaded truth,
From off this brier pluck a white Rose with me."

To which Somerset answers:

"Let him who is no coward, nor no flatterer,
But dare maintain the party of the truth,
Pluck a red Rose from off this thorn with me."

9. About this time John Morton, Bishop of Ely, had a garden at Holborn, where he grew excellent strawberries. Shakespeare commemorates the good bishop's garden in his tragedy of "Richard III," making his dwarfed, misshapen hero speak after this wise:

> "My Lord of Ely, when I was last at Holborn,
> I saw good strawberries in your garden there,
> I do beseech you, send for some of them."

10. Sir Thomas More had a fine garden at Chelsea, which was a place of resort to princes and learned men, and elicited praise from Erasmus. Here Henry VIII used to walk with the master of the beautiful grounds, with an arm around More's neck; but when, a few years later, the Lord Chancellor would not sanction his divorce and his marriage with Anne Boleyn, this same king had Sir Thomas's head cut off at the Tower.

11. There are many other gardens of note and interest mentioned in history, a tithe of which we have not time to name. Even as we write there comes to us the scent of the fruit-trees that Henry IV planted at Montpellier, and of the aromatic herbs in the botanical gardens of Alphonse d'Este, Duke of Ferrara. Who would not like to have wandered with Pope through his attractive garden at Twickenham, or to have seen Swift cutting asparagus in the garden of Sir William Temple? As we glance down through the ages it almost seems as if the best part of history had been enacted in a garden—at least its most social and gossipy features. Solomon wooed his dusky,

dark-tressed bride in a garden; and on the monuments of Assyria King Sennacherib is represented drinking wine with his queen under a flower arbor in a spacious pleasance. So love and life have moved on, while their brightest splendor seems to hover around the walks and terraces, the arbors and fountains, of these earthly paradises. Let us obey the behest of the wise caliph Abd-er-Rahman, and plant gardens.

F. M. Colby, "The Ladies' Floral Cabinet."

THE CHESTNUT-TREE.

1. The chestnut (*Castanea vulgaris*) is a tree of rapid vegetation, and endowed with great longevity. It attains a height of twenty to one hundred feet, occasionally presenting an enormous circumference. Its leaves are large, petiolate, oblong, acutely lanceolate, deeply dentate, coriaceous, smooth, and shining, with prominent secondary parallel nerves, accompanied by two caducous stipules.

2. The flowers are unisexual, and appear after the leaves. The male flowers are very small catkins, each flower being composed of five or six divisions, with as many or more stamens, having bilocular anthers opening from without. The female flowers are, to the number of five or six, enveloped in a common four-lobed involucrum consolidated externally with numerous unequal linear bracteoles. Each female flower consists of a lower ovarium, surmounted by a calyc-

inal limb, having five to eight lobes, and an equal number of styles. It incloses a like number of cells containing two anatropal ovules. When arrived at maturity, which is in the month of September or October, the involucrum is thick and coriaceous, charged on the outside with a soft prickly fasciculated envelope, and inclosing from one to five unilocular fruits by abortion, known under the name of chestnuts. The pericarp is coriaceous, fibrous, and hairy on its external surface. The seed contains an embryo without albumin, under a membranous covering; the cotyledons are voluminous, and plicated with fissures of greater or less depth, and, as is said, farinaceous. The chestnut is the principal produce obtained from this useful tree; this fruit forms the principal food of the poor populations of the central flats of France and of the valleys of the Alps. Improved by culture, the chestnut-tree has given place to the variety called *marronier*, by the French cultivators, of which several varieties are known. They yield the large chestnuts which sometimes come into our markets.

3. The native country of the chestnut is not very clearly ascertained; it is probably Asiatic, however—at least, the common name is Turkish, and is derived from their custom of grinding up the nuts and mixing it with the food of broken-winded horses, and probably of others also when favorites.

4. The famous chestnut-tree of Mount Etna, said in Sicily to be the "Chestnut of a Hundred Horses," is reported to be one hundred and seventy feet in circumference. Jean Houel gives the history and di-

mensions of this gigantic tree. "We departed," he says, "from Ace-Reale in order to visit the chestnut called of 'the hundred horses.' We passed through Saint Alfro and Piraino, where these trees are common, and where we found some superb old chestnuts. They grow very well in this part of Etna, and they are cultivated with great care. Night not having yet come, we went at once to see the famous chestnut which was the object of our journey. Its size is so much beyond all others that we find it impossible to express the sensation we experienced on first seeing it. Having examined it carefully, I proceeded to sketch it from Nature. I continued my sketch the next day, finishing it on the spot, according to my custom, and I can now say that it is a faithful portrait, having demonstrated to my own satisfaction that the tree was one hundred and sixty feet in circumference, and having heard its history related by the *savants* of the hamlet. This trees is called the 'Chestnut of a Hundred Horses' in consequence of the vast extent of ground it covers. They tell me that Jean of Aragon, while journeying from Spain to Naples, stopped in Sicily and visited Mount Etna, accompanied by all the noblesse of Catania on horseback. A storm came on, and the queen and her *cortége* took shelter under this tree, whose vast foliage served to protect her and all these cavaliers from the rain. It is true that out of the hamlet the tradition of the queen's visit is looked upon as fabulous; but, however that may be, the tree itself seems very capable of doing the office assigned to it.

5. "This tree with its vaunted diameter is entirely hollow. It is supported chiefly by its bark, having lost its interior entirely by age; but is not the less crowned with verdure. The people of the country have erected a house here, with a sort of furnace for drying the chestnuts and other fruits which they wish to preserve. They are even so indifferent to the preservation of this wonderful natural curiosity that they do not hesitate to cut off branches to burn in the furnace.

6. "Some persons think that this mass of vegetation is formed of many trees which have united their trunks; but a careful examination disposes of this notion. They are deceived. All the parts which have been destroyed by time or the hand of man have evidently belonged to a single trunk. I have measured them carefully, and found the one trunk, as I have said, one hundred and sixty feet in circumference."

7. We should be inclined to adopt the opinion here hinted, that this monster tree was the union of several, but M. Houel's sketch and description seem conclusive; and his opinion is further confirmed by the fact that many chestnuts in the neighborhood of Mount Etna are twelve yards in diameter, while one actually measures eighty-three feet.

8. Now, what age can be assigned to the Mount Etna chestnut? It is difficult to say. If we are to suppose that each year its concentric layers have only been a line in thickness, this venerable tree would be not less than thirty-six hundred and forty years old.

Louis Figuier, "The Vegetable World."

THE BANANA.

1. The wonderful luxuriance of tropical vegetation is perhaps nowhere more conspicuous and surprising than in the magnificent *Musaceæ*, the banana (*Musa sapientum*) and the plantain (*Musa paradisiaca*), whose fruit most probably nourished mankind long before the gifts of Ceres became known. A succulent shaft or stem, rising to the height of fifteen or twenty feet, and frequently two feet in diameter, is formed of the sheath-like leaf-stalks rolled one over the other, and terminating in enormous light-green and glossy blades, ten feet long and two feet broad, of so delicate a tissue that the slightest wind suffices to tear them transversely as far as the middle rib. A stout foot-stalk arising from the center of the leaves and reclining over one side of the trunk supports numerous clusters of flowers, and subsequently a great weight of several hundred fruits about the size and shape of full-grown cucumbers. On seeing the stately plant, one might suppose that many years had been required for its growth; and yet only eight or ten months were necessary for its full development.

2. Each shaft produces its fruit but once, when it withers and dies; but new shoots spring forth from the root, and before the year has elapsed unfold themselves with the same luxuriance. Thus, without any other labor than now and then weeding the field, fruit follows upon fruit, and harvest upon harvest. A single bunch of bananas often weighs from sixty to

seventy pounds, and Humboldt has calculated that thirty-three pounds of wheat and ninety-nine pounds of potatoes require the same space of ground to grow upon as will produce four thousand pounds of bananas.

3. This prodigality of Nature, seemingly so favorable to the human race, is, however, attended with great disadvantages; for where the life of man is rendered too easy his best powers remain dormant, and he almost sinks to the level of the plant which affords him subsistence without labor. Exertion awakens our faculties as it increases our enjoyments, and well may we rejoice that wheat and not the banana ripens in our fields.

4. As the seeds of the cultivated plantain and banana never, or very rarely, come to maturity, they can only be propagated by suckers. "In both hemispheres," says Humboldt, "as far as tradition or history reaches, we find plantains cultivated in the tropical zone. It is as certain that African slaves have introduced, in the course of centuries, varieties of the banana into America as that before the discovery of Columbus the plantain was cultivated by the aboriginal Indians. These plants are the ornaments of humid countries. Like the farinaceous cereals of the north, they accompany man from the first infancy of his civilization. Semitical traditions place their original home on the banks of the Euphrates; others, with greater probability, at the foot of the Himalayas. According to the Greek mythology, the plains of Enna were the fortunate birthplace of the cereals;

but while the monotonous fields of the latter add but little to the beauty of the northern regions, the tropical husbandman multiplies in the banana one of the noblest forms of vegetable life."

5. The *Musaceæ* are not only useful to man by their mealy, wholesome, and agreeable fruits, but also by the fibers of their long leaf-stalks. Some species furnish filaments for the finest muslin, and the coarse fibers of the *Musa textilis*, known in trade under the name of manilla hemp, serve for the preparation of very durable cordage.

G. HARTWIG, "The Tropical World."

THE WATER-LILY.

1. OH, beautiful thou art,
Thou sculpture-like and stately river-queen!
Crowning the depths, as with the light serene,
Of a pure heart.

2. Bright lily of the wave!
Rising in fearless grace with every swell,
Thou seem'st as if a spirit meekly brave
Dwelt in thy cell.

3. Lifting alike thy head
Of placid beauty, feminine, yet free,
Whether with foam or pictured azure spread
The waters be.

HEMANS.

Climbing for Palm Wine.

PLANT-LORE.

1. Apart altogether from the more or less vague and valueless symbolism, direct or indirect, understood as the Language of Flowers, there is an abundant store of traditionary lore associated with all kinds of trees, plants, and flowers. The study of this throws much light on many puzzling survivals in popular folklore, and Mannhardt (1831–'80) and Mr. J. G. Frazer have shown its importance for part of the problem of primitive religion. It is not infrequent among Australians and red Indians to find the totem (the name or symbol of a tribe) taking the form of a plant or tree, and for these the individual shows his reverence by refusing to gather or destroy them. We find the worship of trees widely prevalent among savages everywhere, and we have ample evidence that it was an important element in the religion of all the families of the Aryan stock. Grimm thinks the oldest sanctuaries of the Germans were natural woods, and hints at a historical connection between the ancient sacred inviolate wood and the later royal forest —a ludicrous descent from the god to the game-preserver. The oak-worship of the ancient Druids, the sacred fig-tree of Romulus in the center of Rome, the *Ficus religiosa* of India, and the sacred groves of the Semitic and pre-Semitic races still surviving at Carthage a century after Augustine are ready examples of tree-worship from sufficiently wide centers of civilization.

2. The primitive mind of the savage readily conceives of a tree as animated by a conscious soul cognate with his own, and he may regard the tree either as its permanent outward organism or merely its characteristic dwelling-place. Hence trees have their place in the doctrine of fetichism, of idolatry, and the upward development of religion. Buddhists do not include trees among sentient beings possessing mind, but recognize the existence of the genius of the tree, and Buddha himself was such as often as forty-three times during his transmigrations. The reverence paid to the famous Bo-tree shows how fundamental a fact is tree-worship, which undoubtedly formed a part of the old indigenous religion amalgamated by the new philosophical faith. But none the less are the sacred tree and grove to be found within the range of Semitic and Aryan influences, and the obstinate revival, even under the shadow of purer rites, of the Canaanitish Ashera worship proves how deeply they were rooted in the old religion of the land. From all sides we find evidence at once of the great antiquity and uniformity of the worship of trees, whether for the services they render to man, for their venerable antiquity, their form, for particular qualities ascribed to them as containing the seeds of fire, for their situation, as on somber and lonely mountain-tops, or for their association with certain phenomena, as plagues and pestilences, or certain events in the history of the homestead.

3. In the growth, life, decay, and death of the plant, the primitive man easily sees an analogue to

his own life-history, and herein we may find the philosophy of the widespread rustic rites associated with marriage and with the birth of children. The custom of scattering flowers and the fruits of the field over the footsteps of a newly married pair conveys an obvious reference to the belief in the reproductive powers of vegetation and to the fundamental postulate of all sympathetic magic that any effect may be produced by imitating it. Primitive ideas of the fertilizing and fruit-bearing powers of Nature led easily, according to Mannhardt, to the belief that each tree or plant possesses spiritual as well as physical life, being tenanted either by semi-divine spirits or by the ghosts of the dead; and a natural generalization of this notion made plants and trees collectively the abode of particular inhabitants—an example of animism developing into polytheism. A forest-god has been deduced from a mere tree-soul, both alike regarded as powerful to produce rain or sunshine, to cause fruits to spring and cattle to easily bring forth their young.

4. A still higher generalization gave a belief in a genius of plant-life or forest-life, or, higher still, a genius of growth or fertility in general. This universal genius of growth was symbolized by a bush or tree, brought in triumph from the forest, gayly decked, and solemnly planted near the homestead or in the village. We have thus seen both the spirit incorporate in the tree, suffering and dying with it, and the tree considered as the mere dwelling-place of the god; but still further in many cases we find the tree-

spirit regarded as detached from the tree, and, through a confusion of his vegetable and anthropomorphic representations, clothed in human form as a man or a girl decked with flowers—the May King, Queen of the May, the Old Woman or Corn-mother of German harvest-fields, the Jack in the Green of young London sweeps, and the like. The existence of those corn-spirits which especially haunted and protected the waving corn, we see dimly recognized in characteristic ceremonies of an English harvest-home, and in the German custom of leaving the last sheaf of rye in the field as a tribute to the Roggenwulf. The French and German custom of the Harvest May, in which a branch or tree decked with ears of corn is carried home in the last wagon from the harvest-field and hung on the roof of the farmhouse till next year, is closely cognate with the *eiresione* of ancient Greece, and suggests a parallel with some of our own old harvest customs.

5. Sympathetic affinities between plant and animal life strongly impress the primitive imagination; we find them playing an important part in many cosmogonies, as in the Iranian account of how the first human pair grew up as a single tree, the fingers or twigs of each one folded over the other's ears, till the time came when they were separated and infused by Ahuramazda with distinct human souls. Other mythical cosmogonic trees that need only be named are the heavenly fig-tree of the Vedas, and the ash-tree Yggdrasil of Norse mythology. In some places trees are informed when their owner dies, and an

apology formally made to them by the woodcutter before he fells them; and every one is familiar with the custom of planting a tree at the birth of a child, and the notion of a sympathetic relation subsisting throughout life betwixt the two.

6. The trees planted by Queen Victoria on her visit to an English town and the Trees of Liberty planted to mark a new political *régime*, convey unconsciously a survival of the same sympathetic symbolism. The belief that a child's rickets can be cured by passing him through a cleft ash-tree, still lingers obstinately in corners of England, and stories of trees giving forth human groans and exuding human blood are common in folk-tales everywhere. Even so late as 1870, in Oxfordshire, a gypsy woman told how Fair Rosamond was changed into a "Holy Brier," which bleeds if one plucks a twig. Families, as well as individuals, have tutelary or guardian trees, and Hyten-Cavallius, for example, tells us that the three families of Linnæus, Lindelius, and Tiliander were all called after the same tree, an ancient linden or lime which grew at Jonsboda Lindergord. When the Lindelius family died one of the old lime's chief boughs withered; after the death of the daughter of the great Linnæus the second main bough fittingly bore leaves no more; and when the last of the Tiliander family expired the tree's active life came to an end, though the dead trunk still exists and is highly honored.

7. We see, then, how natural is the notion of symbolizing the genius of vegetation under the form of a

tree, and thus, as has been shown, we find some hint at the real philosophy underlying the joyous Old-World May-day usages, the Maypole decked with streamers, round which young men and maidens danced in chorus, and not less the high ceremonies attending the harvest-home. Even our Christmas-tree, which originally made its way into England and France principally through the influence of Prince Albert and the Duchess Helen of Orleans, is really nothing but a survival of an ancient German custom of heathen origin, and we may safely disregard the foolish theory of its being Christian because the 24th of December chances to be consecrated to Adam and Eve. One legend relates how Adam brought from paradise a fruit or slip from the tree of Knowledge, from which sprang the tree from which the Cross was made—an example of a process of myth-making after the fact to which we owe not a few beliefs and customs not understood. But many plants have received a kind of religious consecration from the name of some saint whose festival fell on the day on which they were gathered. And Christianity, like Buddhism, early showed a marvelous adaptability in the way in which it adopted popular rites of an earlier religion and subtly rebaptized them as its own.

8. Many remnants of primitive superstitions survive in the local English names of plants and flowers, chiefly in connection with the fairies, the devil, the Virgin, and the Cross, and we have a great wealth of association from one cause or other between saints and flowers, as St. Agnes with the Christmas rose,

St. Joseph of Arimathea with the Glastonbury thorn, St. Patrick with the shamrock, the Virgin with the white lily, just as Thor had his oak-tree, Venus her myrtle, the Indians the lotus, and the Druids the mistletoe. Again, historical personages and families are frequently associated with particular flowers—it is enough merely to name the orange-lily, the red and white roses, the fleur-de-lis, the *Planta genista*, and the violet. Family and clan crests frequently take this form, as the fir, holly, juniper; also national badges, as the rose, thistle, shamrock. More curious and interesting, although obscure, are the notions of magical properties connected as persistently with some plants as medicinal properties are with others. Most prominent in European folklore are the elder, the thorn, and the rowan or mountain-ash; but strange properties are still ascribed to the rosemary, vervain, St. John's-wort, mandrake, asphodel, and to fern-seed; and many flowers lend themselves through some obscure inherent fitness to special methods of divination.

9. The doctrine of signatures, of such importance in the history of medicine, opens up a special chapter of sympathetic magic, involving the belief that plants bore by nature marks indicating plainly for what diseases they were medicinally useful. The trees of Paradise, of Chaldæan and other cosmogonies, the oracular oaks of Dodona, those trees of healing spiritually allegorized in the Apocalypse, the Trees of Liberty of the French Revolution, and the trees round which an Indian bride and bridegroom walk hand in

hand, point as unmistakably to a real sympathetic affinity between the human and the vegetable world as did the dryads, fauns, and satyrs of the ancient Hellenic mythology, with their analogues our own elves and fairies of the woods, the transformation-myths, the Orpheus whose lyre laid its charm on beasts and trees alike, or the Pan at the report of whose death all Nature mourned aloud.

ANONYMOUS, "Chambers's Encyclopædia."

THE LONGEVITY OF TREES.

1. IN the vegetable world limits of growth and life are strangely diversified. Multitudes of forms mature and perish in a few days or hours, while others, whose beginning was in a remote antiquity, have survived the habitual period of their kind, and still enjoy the luxuriance of their prime. Some species of unicellular plants are so minute that millions occur in the bulk of a cubic inch, and a flowering plant is described by Humboldt, which, when fully developed, is not more than three tenths of an inch in height. On the other hand, we have the great Sequoia, whose mass is expressed by hundreds of tons, and specimens of the Eucalyptus growing in the gulches of Australia surpass in height the dome of St. Peter's.

2. Some of the Fungi mature between the setting and rising of the sun, while the oak at our door, which

awakens the memories of our childhood, has not perceptibly changed in bulk in half a century. Trees grow more slowly as they increase in age. Nevertheless it is certain that growth continues while they continue to live. The development of foliage implies interstitial activity and organization of new material. In its vital processes there is little expenditure of force or waste of substance. Its functions are essentially constructive, and its growth and age are apparently without limits, excepting such as arise from surrounding conditions. Thus many trees represent centuries, and have a permanence that is astonishing and sublime. Travelers stand awestruck before the monuments which for forty centuries have kept watch by the Nile, but the oldest of these may not antedate the famous dragon-tree of Teneriffe. It is not surprising that the ancients considered trees "immortal," or as "old as Time."

3. But if the life of the tree is continuous, its leaves—the organs of its growth—have their periods of decay, and are types of mortality. The life of man is likened to the "leaf that perishes." In an animal, the vital processes are carried on by a single set of organs, the impairment of which limits the period of its life. With the tree, decay of the organs is followed by constant renovation, and the foliage which covers it the present summer is as new and as young as that which adorned it a hundred or a thousand years ago. Trees which shed their leaves annually, or at longer intervals as do the evergreens, grow by formation of new wood in layers upon their outer

surface, and just beneath the bark. These constitute the class *Exogens*, or outside growers. A layer represents the growth of a year. Where these are accessible, there is no difficulty in ascertaining the age of a tree, or the rate of its growth; and the rate thus ascertained may be applied to other trees of its kind whose diameter is known, although its woody layers be inaccessible. In this way the age of many trees has been estimated. The relation between the age of a tree and its annual rings was first noticed and applied by Montaigne, in 1581.

4. But this method of ascertaining a tree's age does not apply to the class *Endogens*, in which the growth is internal. In these a hard inflexible shell forms around the inner portions, the tree increases little in diameter, and no woody layers are found. To this class belong the Palms. The age of this class of trees is estimated by comparing specimens with others whose age is known, or from an ascertained rate of growth. The oldest palms may not exceed five centuries, and their average period is probably less than two hundred years. The height of the tallest of the species is said to be one hundred and ninety-two feet. Trees growing in dense forests are comparatively short-lived, and attain less bulk than those in open places, where side-branches develop in the unobstructed rays of the sun. In similar conditions the age and dimensions attained by trees of each species are tolerably constant. Thus the average period of oaks and pines may be three or four hundred years; but the exceptions are so numerous and won-

derful that we shall present here a few of the most interesting and best-authenticated instances.

5. Of the white-pines, once the glory of the New England forests, we are not aware that any have been found more than four hundred and thirty years old. Nor have we any oaks of extraordinary age. The Charter oak at Hartford may have been a small tree at the first settlement of New England. The Wadsworth oak, at Geneseo, New York, is said to be five centuries old, and twenty-seven feet in circumference at the base. The massive, slow-growing live-oaks of Florida are worthy of notice, on account of the enormous length of their branches. Bartram says: "I have stepped fifty paces in a straight line from the trunk of one of these trees to the extremity of the limbs."

6. The oaks of Europe are among the grandest of trees. The Cowthorpe oak is seventy-eight feet in circuit at the ground, and is at least eighteen hundred years old. Another, in Dorsetshire, is of equal age. In Westphalia is a hollow oak which was used as a place of refuge in the troubled times of mediæval history. The great oak at Saintes, in southern France, is ninety feet in girth, and has been ascertained to be two thousand years old. This monument, still or recently flourishing, commemorates a period which antedates the first campaign of Julius Cæsar!

7. The Oriental plane-tree is noted in Eastern countries for its size and longevity. There is one near Constantinople which is one hundred feet high

and one hundred and fifty feet in circuit. It has been suggested that this is really a group of trees originally planted near together for their shade. A photograph, however, hardly confirms that opinion, and many trees of this species are mentioned by travelers not greatly inferior to this one in dimensions. Most of the old plane-trees are hollow, their tops being sustained by wood of recent growth. In this respect an exogenous tree resembles a coral reef, where the vitality and growth are at the surface only.

8. Of chestnuts, we have the famous one at Tortworth, in Gloucestershire, England, which was a large tree in the reign of King Stephen, and is over one thousand years old. The "Great Chestnut of Mount Etna" consists, at present, of what appears to be several trees, fragments of the original one. These are by some supposed to be shoots from, rather than portions of, the old tree. Jean Houel, who examined the trees, says "they are portions of one tree." By removing the soil, the outer rim of the tree has been found, and the circumference ascertained to be one hundred and seventy-five feet. Other chestnuts near this are in girth sixty-four, seventy, and seventy-two feet respectively.

9. The lime or linden in Europe is an important tree. Those in the town of Morat are celebrated in the history of Switzerland. One was planted in 1746 to commemorate the defeat of the Burgundians under Charles the Bold; the other was a noted tree at the time of the battle, and is now near nine centuries old. But, equally famous is the one at Wür-

temberg, called the "Great Linden" six centuries ago. It is probably one thousand years old, and measures thirty-five feet in girth. Four and a half centuries ago its branches were supported by sixty-seven columns of stone, now increased to one hundred and six, many of which are "covered with inscriptions."

10. The well-known olive-tree is associated with our most cherished recollections. There is an old one near Nice, twenty-four feet in girth, regarded by the inhabitants with great interest. Those on the Mount of Olives may be contemporary with the Christian era. They are known to have been in existence in 1217, when the Turks captured Jerusalem.

11. The evergreen cypress, long celebrated for its longevity, is abundant in the burial-grounds of Eastern nations, and, from its dark, dense foliage, forms an impressive picture of Oriental landscapes. In the Palace Gardens of Granada are cypresses said to be eight hundred years old; and there is one at Somma, in Lombardy, proved by authentic documents "to have been a considerable tree forty years before the Christian era." Of this family of trees is our well-known white cedar, specimens of which exhumed from the meadows on the coast of New Jersey had from seven hundred to one thousand rings of wood solid and fragrant as if of recent growth.

12. The cedars of Lebanon are often referred to in the Sacred Writings. The present trees are, we believe, seven large ones, with many of smaller growth, situated in an elevated valley of the Lebanon Moun-

tains, six thousand one hundred and seventy-two feet above the Mediterranean. The valley is surrounded by peaks of the mountains, which rise three thousand feet higher, and are covered with snow. De Candolle supposes the oldest are twelve hundred years old, but no sections of their wood have been examined to determine their age. The cedar is known to grow slowly, as does the North American or bald cypress. This latter tree is common in our Southern States, and its rate of growth has been determined. On the Mexican table-lands its growth and antiquity are immense. The "Cypress of Montezuma," near the city of Mexico, is forty-four feet in girth, and its age is estimated at upward of twenty centuries. In the churchyard of Santa Maria del Tule, in the Mexican State of Oaxaca, is a cypress which "measures one hundred and twelve feet in circuit, and is without sign of decay." At Palenque are cypresses growing among the ruins of the old city, whose streets they may have shaded in the days of its pride. By the usual methods the age of the cypress at Santa Maria del Tule is calculated at five thousand one hundred and twenty-four years, or, if it grew as rapidly during its whole life as similar trees grow when young, it would still be four thousand and twenty-four years old.

13. The yew has long been used in Great Britain as an adornment of places of sepulture, and is often referred to in English literature:

"Beneath these rugged elms, that yew-tree's shade,
Where heaves the turf in many a moldering heap."

This tree, of almost imperishable wood, is indigenous to Great Britain. De Candolle ascertained its rate of growth, and concluded that individual specimens are of great antiquity. There is a yew at Ankerwyke House older than Magna Charta. It was an old and celebrated tree when King John met the barons at Runnymede, in 1215, and its age is upward of eleven centuries; but the yews of Fountain's Abbey and the Darley yew are from three to five centuries older than this. In Fortingal Churchyard, Perthshire, is a yew eighteen feet in diameter, through decayed portions of which funeral processions pass on their way to the grave. The age of this tree is estimated at eighteen hundred years. But of greater antiquity is the one described by Evelyn, which stood in Braborne Churchyard, in Kent. It measured fifty-nine feet in girth, and was believed to be twenty-five hundred years old. This tree, which has long disappeared, was probably contemporary with the founding of Rome. The growth and decline of a great empire was spanned by the duration of a single life.

14. More immense in bulk, but perhaps not older than these living monuments, are the pines of Oregon and the Sequoias of California. Mr. Douglas counted eleven hundred annual layers in a Lambert pine, and three hundred feet is not an unusual height for the Douglas spruce. Hutchings states that a Sequoia which was blown down and measured by him was four hundred and thirty-five feet in length. It was eighteen feet in diameter three hundred feet from the ground. Scientific observation has connected

with these trees an interest equal to that awakened by their size and age. Our most distinguished botanist, Prof. Gray, has shown that the Sequoias, now growing on a limited area, had formerly a wide distribution, and are lineal descendants from ancestral types which flourished at least as far back in geologic time as the Cretaceous age. The descent has been with modifications furnishing an important link in the chain of evidence which establishes the derivative origin of specific forms. Prof. Gray thinks the age of the oldest living Sequoia may be about two thousand years, and remarks: "It is probable that close to the heart of some of the living trees may be found the circle which records the year of our Saviour's nativity."

15. The sacred banian is familiar to every reader. Its main trunk attains a diameter of from twenty to thirty feet, and its enormous roof of foliage may shelter the inhabitants of a considerable village. The pendent branches are really roots, which, on reaching the ground, penetrate it and form trunks. These correspond with the outer layers of wood in an oak or a pine, and sustain the top, although the original trunks decay and disappear.

16. The dragon-tree of Orotava, on the island of Teneriffe, is a well-known and historic tree. Twice during the present century it has been dismantled by storms. It is but sixty-nine feet high, but is seventy-nine feet in circumference. So slow is its growth that its diameter had scarcely changed in four hundred years. Recently it bore flowers and luxuriant

A Dragon Tree, Teneriffe.

foliage, as it may have done before the "isles of the Western Ocean," on one of which it was growing, were a dream in the Grecian mythology.

17. The baobab, or monkey bread-fruit, is the last we can notice of the ancient trees. It was first described by a Venetian traveler in 1454. These trees are found, however, in nearly all portions of Africa south of the Desert, everywhere an imposing feature of the landscape, and objects of regard if not of reverence by the natives. In the rainy season they are in full luxuriance, and are covered with cup-shaped flowers six inches in diameter. The trunks grow from twenty to sixty feet high, but are sometimes one hundred feet in circuit at the ground. The baobabs, like most other trees, grow rapidly when young, but slowly when old. Recent estimates attribute to some of the oldest a period of three thousand years. This is scarcely more than one half the age assigned to them by early writers. In 1832 a baobab was transplanted into a garden at Caracas, which grew as much in forty years as would have required one hundred years by early estimate. By the native town of Shupanga, near the Zambesi, in eastern Africa, is a venerable baobab, beneath which is the grave of Mrs. Livingstone.

18. Such, briefly, are some of the great living monuments of the vegetable kingdom. In longevity they are in striking contrast with higher types of life. Fixed to a single spot, the tree is what it is because of the forces which act upon it. It is a monument of accumulated and concentrated force. Transmuted

sunlight is in all its fibers, and who shall estimate the dynamic work which has been expended in its structure?

19. Dr. Draper observes that "the beat of a pendulum occupies a second of time; divide that period into a million of equal parts, then divide each of these brief periods into a million of other equal parts —a wave of yellow light during one of the last small intervals has vibrated five hundred and thirty-five times. Yet that yellow light has been the chief instrument in building the tree." In the delicate texture of its leaves it has overcome molecular force; it has beaten asunder the elements of an invisible gas and inaugurated a new arrangement of atoms. The old dragon-tree represents forty centuries of this dynamic work—a sublime monument reared without toil by the silent forces of Nature!

20. In the outer air it has awakened every note of sound, from the softest monotone to the rhythmic roar of the tempest; but in its inner chambers has been a murmur and music of life in the ceaseless movement of fluids and marshaling of atoms, as one by one they take their place in the molecular dance, which eludes the dull sense of hearing and becomes obvious only in results. The veil which hides these ultimate processes of life has not yet been lifted, and science pauses in waiting before it, but only waits.

ELIAS LEWIS, "The Popular Science Monthly."

GRASSES.

1. Of all the plants covering our hills and valleys, grasses are the most general and the most important. We attach great and deserved importance to utility, and seldom stint our meed of praise to beauty; yet as we pluck up the grassy weeds in our flower-beds or sentence the garden-walk to a covering of salt to destroy the young grass-blades, how little we recognize how beneficent and lordly a family we are making war with! yet, as the term *weed* has been well defined as "a plant growing where it is not wanted," the young grasses, so valuable in the meadows or pasture, are deserving of extermination when they intrude themselves into the *parterre*.

2. Linnæus has computed grasses to constitute a sixth part of all the vegetables of the globe. They prevail especially in open situations, and spread themselves by their creeping habits to a great extent. The family is numerous, and very widely distributed. Persoon's "Synopsis" contains eight hundred and twelve species, and Römer and Schultes enumerate eighteen hundred. Their diffusion is coextensive with the existence of vegetation. Travelers penetrating to the South Shetland Isles find *Aira antarctica* flourishing alone and spreading its light panicles in a region of "thick-ribbed ice"; *Agrostis algida* was found by Phipps on Spitzbergen; and in Greenland and Iceland, where there is scarcely light enough for the humblest vegetables to flourish, *Trisetum sub-*

spicatum not only endures the sleet and bitter cold, and spreads its blossoms under such inhospitable circumstances, but actually ripens abundance of seed. On the mountain ranges of the south of Europe grasses ascend almost to the snow-line, especially *Poa disticha*, *P. malulensis*, and *P. dactyloides*, and *Festuca dasyantha*.

3. Under the equator characteristic grades are found; indeed, it is impossible to find a climate to which they will not suit themselves. They occur in every soil, in company and alone, often covering large areas with a single species, or combining half a dozen in a square inch. Every kind of soil has its special patrons in the family, but fewer species favor sandy ground than other kinds. Some grow in water, many in marsh and bog, but there are no marine species. No matter how barren the spot, grasses of some kind will establish themselves there; the rocky fissures have their fringe of feathery grasses, the tops of walls or "dikes" are green with them, and the decaying ruin is as surely decked with grass plumes as with the soft drapery of moss and lichen. Dr. Deakin enumerates fifty-six species found by him on the ruins of the Colosseum, and we can none of us call to mind a gray ruin of abbey or fortress without its complement of commemorative grasses. There is no place where the presence of grass is more welcome or more touching in its associations than in the churchyard. The early withering of many summer grasses brings to memory the scriptural analogy "All flesh is as grass"; but the associations with the

green turf of Nature's lost home are entirely restful. The American poet expresses genial feeling on this subject in some simple lines on "The Voice of the Grass":

"Here I come creeping, creeping everywhere;
By the rusty roadside,
On the sunny hillside,
Close by the noisy brook,
In every shady nook,
I come creeping, creeping everywhere.

"Here I come creeping, creeping everywhere;
In the noisy street
My pleasant face you'll meet,
Cheering the sick at heart,
Toiling his busy part,
Silently creeping, creeping everywhere.

"Here I come creeping, creeping everywhere;
When you're numbered with the dead,
In your still and narrow bed,
In the happy spring I'll come
And deck your silent home,
Creeping silently, creeping everywhere."

4. Mr. Shirley Hibberd describes the welcome presence of grass in truly poetic style. He says: "Grass climbs up the steep mountain passes and forms green ledges among the rivings of the crags; it leaps down between steep shelving precipices, and there fastens its slender roots in dry crevices which the earthquakes have rent long ago, and into which the water trickles when the sunbeams thaw the hoary snows above. There it flings its sweet greenness to

the sun, creeps about in the mazes of the solitude, and waves its fairy tassels in the wind. It even beautifies the grave, and spreads over the sightless visage of death and darkness the serene luster of a summer smile."

5. In our climate the idea of grass is always connected with the velvety sward of hill and park, or the quivering plumes of the fragrant meadow; but in tropical countries the character of the grasses is quite different. There you may search in vain for the compact elastic turf over which our childhood's feet have loved to bound; grasses you find indeed, but seldom crowded together and interwoven into a natural carpet. There they grow dispersed or in clusters, attaining a lordly size, and exhibiting gigantic plumes of flowers of surpassing beauty. Nearly all tropical grasses attain a height that may be called gigantic in comparison with our temperate species, and some of the bamboos grow to a stature of fifty or sixty feet. Their leaves are broader in proportion, and in most species there are flowers of different sexes on each plant. The flowers are more generally furnished with hairy appendages, or the parts are fringed with silky hairs, often of silvery whiteness, which gives them a very elegant appearance. Thus the tropical grasses make up by their size and beauty for the absence of the ever-welcome turf. In subtropical districts the grasses are of an intermediate size and number, or representatives of the two forms are both present. *Arundo donax*, in the south of Europe, emulates the bamboo in its size and ele-

gance, and several species present the characteristic of the combination of different sexes; the turf, though not absent altogether, is much less compact than in the cooler climates, and meadows are less frequent.

6. Of the many gifts bestowed by our beneficent Creator in the kingdom of Nature, that of the grasses is perhaps the most valuable to the life of man, whether we regard it as "the grass grown for cattle" or "the green herb for the use of man." In the first-named gift we reckon all the agricultural grasses, both natural and artificial, the value of which we only realize when during a drought they are withdrawn. At such a time we are not surprised to hear even of so great and imperious a king as Ahab going forth to see if perchance he can find a little grass anywhere to save some of his cattle alive. And, as in the "green herb for the service of man," we recognize the rank lines of corn growing up—"first the blade, then the ear, and then the full corn in the ear"—yielding at last in the rich harvest time the precious "staff of life," "bread to strengthen man's heart."

7. As food for man and beast, it is impossible to overvalue this great gift of God; nor should we forget how valuable is the turfy carpet overspreading our hills and valleys, both as regards its comfort to the foot of the weary traveler and its charm to the eye. Who that has any taste for the beautiful can fail to admire the glory of the meadow, whether the trembling panicles of its grasses are laden with the

diamonds of the dew or giving out their odor under the influence of the midday sun? And when the summer is over and gone and the rich growth of the meadows stands stoutly in a burly stack, the aftermath is not less profuse in its adornments than was the earlier crop; for, as

"Ilka blade o' grass keps its ain drap o' dew,"

so every blade has its own wreath of jewels bestowed by the breath of the hoar-frost.

8. Very early in the year the grass-flowers come forth to court our regard. The sweet vernal grass leads the first group, and half a dozen have shaken forth their tasseled stamens before the April showers have ceased. May, the month of flowers, boasts but three flowering grasses, one of which is the Holy Grass—so called because dedicated to the Holy Virgin, and used in Prussia and elsewhere in the decoration of the churches, fitting therefore to flower in the month which, like itself, is dedicated to the mother of our Lord. June is rich in grasses; Mr. Lowe enumerates forty-four which flower in that month, but the numbers only reach their maximum in July, when sixty-six perfect their blossoms, according to the computation of the same author. August has but few grasses, and after that the flowers of the family are seen no more, or only in belated individuals.

9. Nearly every grass is wholesome, all the seeds partaking of the nature of the cereals. *Lolium temulentum* is an exception; its seeds have the character

of being narcotic and deleterious and producing intoxication and even convulsions. There are terrible legends of poisoning by darnel-bread, but authors of the present day doubt the truth of the said legends, and return a verdict of "not proven." The seeds of *Bromus mollis* are accounted doubtfully wholesome, and those of the foreign species *Festuca quadridentata* lie under the same suspicion. There is a curious species in New Zealand, called Spear-grass, which is very injurious to the feet of horses and men because of its sharp spines, which are a foot long; the spike measures a yard in length, and the strong sharp awns are truly vegetable spears; Dr. Lauder Lindsay says it is accounted the pest of the province. But these are trifling exceptions where the great numbers of the family are so distinctly wholesome and useful.

10. Cereals of course take the first place in the grass family, being absolutely necessary to the life of the human race. He who created man in his own image had already created for him the "green herb" that should form the most important part of his sustenance, and willed that, by using the talents that he had endowed him with, he should improve and extend, by cultivation, those nutritious seeds, so as to provide food co-extensively with the increased need of it. Thus we have in the large variety of cereals a mere handful of species, placed by the hand of Providence so as to attract the special notice of man from time immemorial, and now become the daily bread of the great human family. Only second in importance

to the cereals stand the agricultural grasses, without which we could not keep our flocks and herds, and so must forfeit all the support and service we receive from them. In temperate climates the earth is covered by the greensward, which furnishes such abundance of pasturage and meadow for our troops of cattle. In the tropical climates the sward is absent, but the grasses are there in another form, and though of gigantic size, many of them are so tender and delicate that they are as valuable as our own as fodder for cattle. In Australia, Kangaroo-grass (*Anthistiria australis*) affords excellent food for sheep, and the Dharba or Doob of India (*Cynodon dactylon*) is so valuable as to be the theme of many poems. Mexico rejoices its flocks with the Gama grass, and the Tussac grass of the Falklands is noted for its nutritious qualities.

11. The group of grasses used for economic and industrial purposes is comparatively insignificant, but by no means unimportant when our attention ceases to be dazzled by the greatness of the value of the cereal and fodder grasses. In many rural districts their utility for thatch, fences, building purposes, and domestic articles is well attested, and neither poor nor rich will despise their employment in the straw-hat manufacture. Ornamental grasses form a very attractive group, as exhibited in our public gardens in the present day, and, though not able to lay claim to edible or industrial properties, they well deserve notice as the fine ladies and gentlemen of the tribe.

MARGARET PLUES, "British Grasses."

Umbrella-Tree.

GIANTS OF THE VEGETABLE KINGDOM.

1. Like animals, plants may be infinitely little or infinitely huge; the latter astonish us by their colossal proportions, while the former escape our ken, and are only revealed by the microscope. The study of the development of plants in respect to their mere size presents us with some curious contrasts.

2. Some rudimentary plants, such as the *Ascophori*, Mold Fungi which so frequently invade our bread, and the *Aspergilli* which we often see forming in the fluids we drink glairy repulsive-looking films, possess an almost invisible stalk. Woody plants, on the contrary, often astonish us by the enormous dimensions of this part. The old authors who describe Germany tell us that there were trees there from the trunk of one of which boats were made which carried as many as thirty men. From the times of antiquity the luxuriant growth of the plane-trees on the banks of the Bosporus and the Black Sea has been the subject of remark, and the botanists of our day have proved that what our forefathers said was in no way exaggerated.

3. Men were almost inclined to disbelieve the account of Pliny, who states that in his time there was in Lycia a stout thriving plane-tree in the trunk of which was seen a vast grotto eighty-one feet in circumference, the whole extent of which had been tapestried by Nature with a green and velvety hanging of moss. Licinius Mutianus, governor of the

province, charmed with the delicious coolness of this rural hall, gave a supper in it to eighteen guests from his suite. After the orgy they transformed the scene of their festivity into a dormitory, and comfortably passed the night there.

4. This fact has been fully confirmed by modern travelers. De Candolle relates that, according to one of them, there still exists in the neighborhood of Constantinople an enormous lime-tree, the trunk of which is quite as ample as that of which we have been speaking. It is one hundred and fifty feet in circumference, and also presents a cavity eighty feet in circuit.

5. Ray, the celebrated English botanist and geologist, speaks of an oak existing in his time in Germany which was of such dimensions that it had been transformed into a citadel. To confine ourselves more strictly to the truth, let us just say that its interior served as a guard-house. We may here mention another tree of the same kind, still growing in Normandy, and which, in contrast to the other, has been consecrated to piety. This is the chapel oak of Allouville, in which there is an altar dedicated to the Virgin, where on certain days mass is said. The ample hollow of this tree not only furnishes an oratory, but above this a sleeping-room has been scooped out; there is a bed in this room, to which access is gained by steps outside; it is the abode of an anchorite. This tree, which perhaps sheltered in its shade the companions of the Seigneur de Bethencourt when on their way to embark for the conquest

of the Canaries, is held in great veneration in the country.

6. One of our most illustrious and philosophic botanists, Marquis, renowned alike for his eminent position and knowledge, measured the trunk of this tree, and found that it was thirty feet in circumference near the ground.

7. I have also seen on the banks of the Bosporus plane-trees the trunks of which were pierced with enormous cavities. In the neighborhood of Smyrna there is one of these trees celebrated for its size and antiquity. The stem, which is hollowed right through, is spread widely out at the base, and represents three columns, which converge toward each other, forming a sort of porch beneath which a man on horseback can pass easily.

8. Yet the baobab on the banks of the Niger, in its splendid luxuriance of growth, surpasses even all the giants of the Bosporus. It is especially remarkable for its thickness, contrasted with its want of height. It is a colossus of ungraceful look. Almost always without leaves, bearing them only in the rainy season, its whitish conical trunk, scarcely fifteen to twenty feet in height, is more than a hundred feet in circumference at the level of the ground. This short and robust support is necessary to sustain its incredibly large dome of leaves, the bulk of which is sometimes so great that, seen from a distance, the baobab looks rather like a small forest than a single tree. Its large branches are fifty to sixty feet long. When time has hollowed out the stem of one of these noble

trees the negroes make use of the cavity. Sometimes they turn it into a place of amusement, a rustic retreat where they can smoke their chibouques and take refreshment; at other times they convert it into a prison. One of these is known of which the Senegambians have converted the interior into a council-hall; the entrance is covered with sculptures which point out the high destination reserved for it.

9. But the marvel of the vegetable kingdom in respect to its colossal dimensions is assuredly the famous chestnut-tree growing on the lower slopes of Etna. Count Borch, who measured the trunk very exactly, accords it a circumference of one hundred and ninety feet. A house which shelters a shepherd and his flock has been built in the immense hollow of its trunk. During the winter the wood of the tree serves the inhabitant of this solitary retreat for fuel, and its abundance of fruit supplies him with food during the summer.

10. This colossus of our forests, which is called the "Chestnut of a Hundred Horses," owes its name to the vast extent of its foliage. The inhabitants of the country told the painter J. Houel "that Jeanne of Aragon, when traveling from Spain to Naples, stopped at Sicily, and accompanied by all the nobility of Catania, paid a visit to Mount Etna. She was on horseback, as were also her suite, and a storm having come on, she took shelter under this tree, the vast foliage of which sufficed to protect the queen and all her cavaliers from the rain. It is from this memorable ad-

venture, they add, that the old tree took the name of Chestnut-tree of the Hundred Horses."

11. Yet whatever astonishment we may feel at the extraordinary dimensions attained by the trunks of certain trees, the height to which others reach strikes us still more than their growth in diameter. The king of our forests, the oak, which poetic fiction looks upon as the emblem of passive force, rears its crown of leaves one hundred feet above the soil.

12. In the East the imposing remains of the ancient forest employed in building the temple of Jerusalem, the cedars of Lebanon, the object of so much veneration, and which the pilgrim only approaches with the sounds of a hymn on his lips, spread forth their dark sheets of verdure to a height of one hundred and fifty feet above the mountain.

13. Supported only by its flexible column, which yields and bends beneath the force of the tempest, the wax-palm on the Andes balances its waving crown in the bosom of the clouds two hundred feet above the heights whereon it grows.

14. But no tree rears its head toward the sky so boldly as the gigantic cedar of California, the *Wellingtonia gigantea.* One colossus of this species, now hurled down and stretched upon the rock, presented when it stood erect and threatening a height of more than four hundred and ninety feet—that is to say, about eight times the elevation of a house of five stories. It was above one hundred and thirty feet in circumference.

15. The bark of the trunk of one of these giants

of the American forests was transported in part to the Crystal Palace at Sydenham, where it formed one of the most splendid curiosities, until accidentally destroyed by fire in 1866. It was a monstrous column, above one hundred and thirty feet in height, and which at the level of the ground had a diameter of nearly thirty-four feet. I stood inside this tree along with fifteen people. At San Francisco a piano was placed, and a ball given to more than twenty persons on the stump of a Wellingtonia which had been brought thither. The age of this colossus corresponds to its dimensions. By counting the number of annual rings in a transverse section, it was ascertained that these monstrous trees must be three or four thousand years old, so that they seem to have been almost contemporary with the biblical creation, and have stood erect and unshaken amid all the commotions of the globe.

16. Alongside of these giants stretched prostrate on the ground man only looks like a pygmy and feels his littleness. He calls them the mammoths of the forest, to show that, like those frightful animals which surpassed all others in their size, they tower above all the vegetable kingdom. One of these cedars, hollowed out into a deep cavern, owes its name of "the Riding School" to the fact that a man on horseback can penetrate sixty-five feet into the dark excavation.

17. However, these prodigies of vegetation do not seem to be the supreme manifestation of creative power. In penetrating into regions of Australia pre-

viously quite unknown, some gold-seekers have just discovered *Eucalypti* that surpass in size even the *Wellingtonia gigantea.* Ferdinand Müller, the botanist, says that trees of the species *Eucalyptus amygdalina* four hundred and eighty feet in length, were met with lying on the ground; and this seems perfectly confirmed by the statement of Mr. George Robins, who saw in the mountains of Berwick one of these trees standing which had, near the ground, a circumference of eighty-one feet, and the height of which he estimated at five hundred feet. This Eucalyptus, therefore, could overshadow the Great Pyramid of Egypt and the spire of the Cathedral of Strasburg, for the former is only four hundred and eighty feet in height and the latter four hundred and sixty-six. Thus these vegetable giants dethrone all others that have hitherto been regarded as the forest monarchs of our globe, and must be added to the marvels that Australia may yet have in store for us.

18. When from these noble trees, proudly cleaving the clouds with their tops, we pass to those whose humble stem creeps upon the ground, we find that even the latter at times acquire a length which has something of the prodigious in it. Struck with the aspect of the vines in Italy, the manifold garlands of which entwine from branch to branch, and disappear amid the foliage of the trees without our being able to see either the beginning or the end, Pliny maintained that they grow forever: *Vites sine fine crescunt*, said the Roman naturalist. But we have more precise data as to the size of sundry other plants.

Thus in the virgin forests of India, the *Calamus rotang*, which climbs upon the trunks of aged trees and stretches from one to another, sinking to the ground to rise again, attains, according to the traveler Loureiro, a length of four hundred to five hundred feet. The gigantic Fucus (*Fucus giganteus*, Linn.) reaches much more extraordinary proportions; the waves of the ocean, according to Humboldt, yield strips which are sometimes fifteen hundred to sixteen hundred feet long.

19. In an interesting article in the "Revue Germanique," M. A. Boscowitz says that in the Botanical Garden of Caracas there was a Convolvulus which in six months attained the incredible length of six thousand feet. It must therefore have grown at the rate of more than a foot per hour, and its growth must have been visible to the naked eye.

F. A. Pouchet, "The Universe."

SIX GREAT GROUPS OF PLANTS.

1. Of the many thousand kinds of plants that have been discovered growing in different parts of the world, only about two hundred and forty kinds have been found by men to be really valuable and useful. Of course, all the plants the Creator has placed in the world serve some useful purpose; but for our own particular use, for food for ourselves or our cattle, or as medicines, or materials for building,

Central American Fruits.

for making clothing, or other things, men have found, after many centuries of trial, only these two hundred and forty kinds that are of real value. Flowering plants are not included among these kinds, though a fine rose or carnation is useful in making our homes beautiful. We shall therefore add flowering plants to the useful plants, and thus greatly increase the number of varieties. Forest trees are also useful, and in many places are now being cultivated in artificial groves; and these, too, we will include among our useful friends.

2. When we are presented to a large party of friends we naturally group them into sets, putting all the men together in one group, all the women in another, and the young folks in another. So now we will arrange our friends, the useful plants, into groups according to their uses. The first of these are the food plants. These include all the plants we can eat, either cooked or raw. These are the most important of all, and give us more wealth from the ground every year than any other group of plants. We could not exist in health without the food plants, and whole nations of people depend wholly upon them. Next in value to these are the fodder plants—the grasses, oats, clover, and others suitable for food for animals. This is also a very large and important class, and without it we could have very few horses, sheep, or cows. These fodder plants bring us great wealth every year by enabling us to keep our animals alive, and thus get food, milk, hides, and other valuable things. Next to the fodder plants come the forest plants, the trees

that give us wood. Though nearly all wood-giving trees grow wild, we must call them useful plants; for wood is the next great supply of wealth we take from our lands. Trees are now being cultivated on farms for their wood, so that many of the trees we once found only in the forests are now cultivated in groves like so many apple- or cherry-trees. The next great group are the fabric plants, or the plants like the cotton-plant, from which we may gather materials that may be woven into fabrics. There is also one more group from which materials are gathered, useful in various ways, and these we call the medicine plants. These include the hop-vine, the poppy, the indigo-plant, and others from which drugs or dye-stuffs are obtained. Lastly, are the flowering plants, which include all plants that are cultivated for their beauty of form, foliage, or blooms. These are quite as much useful plants as any, for they are sold in the market for money, just like oats or potatoes, and thus are a means of winning wealth from the ground.

3. These six groups of plants include all the useful plants that can be grown in any part of the United States. Not all in each group are equally valuable, and in this talk about our useful plants we will select only the most important and valuable and those in most common use. Some plants, we shall find, may be found in two groups—as the turnip and carrot are both food plants and fodder plants. Each group can also be divided into several minor groups, according to the different parts of each plant that are used for food or for other purposes. We can also arrange the

groups in another way, according to the age of the plants—as those that live only one year, and those that live two or more. We can also arrange them in still another way, according to their shape—as those that grow quite low on the ground, those that stand erect like trees, and those that climb, like vines. This arranging of things into groups or classes is called classification; and we shall find it a wonderful help in our studies to carry out this work of grouping plants, as it enables us to easily remember their habits or the manner in which they live and grow, and the different uses to which they may be put. In doing this we will use only the common names that are known in this country.

4. Names were given to plants long centuries before any one thought of the science of botany. But these names became greatly changed in time, and grew to be quite different in different countries—just as we find the onion is *zwiebel* in German, *cebolla* in Spanish, and *oignon* in French. The botanists very wisely gave new names to all the plants, and by using Latin and Greek names made it easy to know the botanical names of all plants, because Latin and Greek are read by many people in all countries. Besides this, the fact that a plant had a botanical name known all over the world prevented mistakes in naming varieties of plants, and gave them universal names well understood in every language. All plants having a common name in English have also a botanical name; but we shall find many useful plants have no common names, and then we must use the

botanical names. We shall find many flowering plants with botanical names that perhaps never had common names, or, if they had them, they have been forgotten, or are fast slipping away, and will in a few years be quite unknown. When a plant has a common as well as a botanical name, it is often the custom to give both, as when we speak of the blue larkspur or the *Delphinium formosum*. We will here use only the common names, except where the common names are not generally known; and should you wish to know the botanical name of any plant, you can easily find it in any good dictionary.

5. We will now arrange our friends in these six groups: The Food Plants—Almond, asparagus, arrowroot, apricot, apple, artichoke; banana, beet, bean, barley, buckwheat, broccoli, bread-fruit; carrot, chives, cabbage, celery, corn, corn salad, cauliflower, citron, cherry, cucumber, chestnut, coca, cress, currant, celery, chicory, coffee, clove; dandelion, date; egg-plant, endive; fig; garlic, gooseberry, ginseng, groundnuts, grape, guava; horseradish; kale, kohlrabi; leek, lettuce, lemon, lentil; melon, mulberry, martynia, mustard, millet, mushroom; nutmeg; oats, olive, onion, okra, orange; papaw, parsnip, parsley, pear, peas, pepper, pumpkin, persimmon, potato, pineapple, plum, peach, pomegranate; quince; radish, rice, rye, rhubarb, rutabaga, raspberry; salsify, skirret, squash, spinach, sorghum, sea-kale, sugar-maple, sugar-cane, strawberry, sweet potato, sago; turnip, tomato, tea; walnut, wheat; yam. The Fodder Plants—Alfalfa; buckwheat,

beans; clover, carrots, corn; grasses; lucerne; mangel-wurzel; oats; peas; rye; sainfoin; turnip; wheat; vetch. THE FOREST PLANTS—Ash, aspen; beech, birch; chestnut, cherry, cedar; ebony; hemlock; linden; maple, mahogany; oak; pine; redwood; spruce; walnut, willow. THE FABRIC PLANTS—Cotton; flax; hemp; jute. THE MEDICINE PLANTS—Annotto; cinnamon, clove, cocoa, castor-oil plant; gourd; hop; indigo; madder; nutmeg; pepper; quinine; sumach; tobacco. THE FLOWERING PLANTS—This is the largest group of all, for it includes many plants that are cultivated for other purposes than their flowers or foliage.

6. These are the names of some of our friends, the useful plants. There are many more, and no doubt you can easily think of others, particularly among the forest plants and flowering plants. Make a list of all you know in your State or neighborhood, and endeavor to understand to which of these six classes they belong.

CHARLES BARNARD, "Talks about our Useful Plants."

THE LOTUS.

1. THERE has been considerable dispute concerning the lotus, as the name is now applied to several distinct species, none of which bear the rich fruit so well known to the ancients, and concerning which so

many charming legends have been told. It was believed that this fruit was so delightful that those who ate of it would never leave the spot where it grew, but for it would abandon home and friends to spend their lives in a dream of serene delight. Homer, in the "Odyssey," mentions the lotus-eaters, who lived on the northern coast of Africa, and records their attempts to detain the followers of Ulysses by giving them the fruit of the lotus to eat, so that they should never wish to leave the spot where it grew. The same poetical idea is known to the Arabs, who call it the "fruit of destiny," which is to be eaten in Paradise, and it is on this foundation that Tennyson built his charming poem of the "Lotus-Eaters":

"The charmed sunset lingered low adown
In the red west; through mountain clefts the dale
Was seen far inland, and the yellow down
Bordered with palm and many a winding vale
And meadow set with slender galingale.
A land where all things always seemed the same!
And round about the keel with faces pale,
Dark faces pale against that rosy flame,
The mild-eyed, melancholy lotus-eaters came!

"Branches they bore of the enchanted stem
Laden with flower and fruit whereof they gave
To each, but who so did receive of them
And taste, to him the gushing of the wave
Far, far away did seem to moan and rave
On alien shores; and if his fellow spake,
His voice was thin as voices from the grave;
And deep asleep he seemed, yet all awake,
And music in his ears his beating heart did make.

"They sat them down upon the yellow sand,
Between the sun and moon upon the shore,
And sweet it was to dream of Fatherland,
Of child, and wife, and slave; but evermore
Most weary seemed the sea, weary the oar,
Weary the wandering fields of barren foam;
Then some one said, 'We will return no more';
And all at once they sang, 'Our island home
Is far beyond the wave; we will no longer roam.'"

2. Among the many varieties of the lotus now known are a few which bear edible fruits, in some cases tasting like a date, and in others somewhat like gingerbread. The mythical lotus has been identified by several botanists with the former or that indigenous to Tunis, which best agrees with the description of Polybius, who describes it as a thorny shrub with berries of the size of an olive. Mungo Park found a species of lotus in Central Africa bearing berries of a delicious taste, which, on being dried and pounded, made very wholesome and pleasant bread. The lotus fruit found in Tunis has a stimulating, almost intoxicating effect, and it is therefore probable that this plant furnished the foundation of the ancient legends. The sacred lotus of the Egyptians was a fine aquatic plant, dedicated to Osiris and Isis, and regarded in Egyptian delineations as signifying the creation of the world. Distinct from this lotus was that known as the blue lotus of the Nile, also a sacred plant. Both these species of the lotus occur frequently as religious symbols and decorations in the temples, and they also appear as favorite subjects for Chi-

nese and Hindoo art in connection with religious worship.

ANONYMOUS, "A World of Wonders."

THE HABITATION OF PLANTS.

1. PLANTS are by no means indifferent to climate. They have their appropriate soils and temperature. Some are found only in wild places, while others flourish in cultured grounds. Many are natives of sandy regions—while a few have their home among the rocks. Some can live only on marshy grounds, where they are seen covering the surface of the water. Finally, the sea has its vegetation—a vegetation which, in its luxuriance, is unsurpassed by that of the most favored land on the globe.

2. There is scarcely a spot of earth where some vegetation can not be found; but the difference between the torrid, the temperate, and the frigid zones, in this respect, is really immense. If we would see vegetation in all its power and majesty, we must go to the region between the tropics. There is that colossus of the vegetable world, the baobab, with a trunk thirty metres in circumference. There the palms live and flourish—that remarkable family—compared with which our finest trees show at a disadvantage. In those climates the grasses become shrubs and the ferns rise to the height of eight or nine metres. It is the region, also, of the most ex-

quisite fruits and the most delicious perfumes. Nowhere is vegetation so vigorous and prolific as in those countries where it is nursed by the fervors of a tropical sun, and by the moisture of great and overflowing streams.

3. But this exuberance of life, while it increases the ability of the strong, would be fatal to the weak. Transport to these fiery climes a frail, delicate *parisienne*, and how soon will she fade—how quickly and inevitably she will perish! Thus are we ever making comparisons between the two kingdoms—comparisons resulting from the fact that out of one great creation, unique and single, as it came from the hand of God, we, in our pride, have chosen to make three. Who is able precisely to tell where one of these three kingdoms ends and the other begins?

4. Natural history is a vast chain in which not a single link is missing, and vainly have the magnates of science sought to find a broken place. On the borders of the mineral kingdom there are individuals that vegetate, while upon those of the vegetable kingdom are some that live.

5. Great heat, unaccompanied by humidity, is not favorable to vegetation. Thus the difference is vast between the countries just referred to and the sandy deserts of Africa, parched by a burning sun—those deserts to explore which seems to be like devoting one's self to destruction—those deserts which, on every side, offer no images but those of desolation and death! High degrees of heat are not fatal to all vegetation. Some plants have been known to resist

a temperature of eighty, and even of a hundred degrees—the latter being the point (centigrade) at which water boils. In the hot springs at Dax, a tremella has been seen to grow and to mature in the water of a fountain which indicates constantly a temperature of seventy to seventy-two degrees.

6. If the vegetation of temperate climes has not the splendor and the magnificence of tropical plants, it is not inferior to them in graceful forms or in abundance of products. Even the north can make its boast in this respect; for there are seen, towering toward the clouds, the lofty pine and hardy fir-tree. On mountains, however, these trees are not found at the elevation of two thousand metres and upward. In their place we find the lote-tree and the birch—trees that can brave a temperature of forty degrees below zero—a degree of cold sufficient to split the stoutest fir. This phenomenon—the cracking of trees in cold weather—was frequently noticed by the French soldiers during the disastrous Russian campaign. On one occasion a company of those poor fellows had seated themselves on the snow in the hope of getting some rest, when they heard near them a succession of violent explosions. "The enemy again!" said they; "always at our heels! with this iron sky above us, and these boundless deserts of snow before us!" With a desperate energy they seize their arms and advance toward the spot from which the sound came. But they find nothing there except trees, which the intensity of the frost had burst with reports resembling those of cannon.

7. The more nearly we approach the poles, the fewer plants we find. In Spitzbergen, in Greenland, and in Kamtschatka the number of species does not exceed thirty.

8. Vegetation not only reaches to the tops of lofty mountains, but penetrates to the greatest depths. It is found in the very entrails of the earth—its darkest caverns and deepest mines. Yet at these two extremities of height and depth it is limited to mushrooms and mosses. In the ascent of a lofty mountain, one will find nearly the same changes in the vegetation which are noticed in traveling from the equator toward the north pole. At the foot of the mountain may be seen the plants which abound on level regions in the south of Europe. The lower zone is occupied by oaks. Five or six hundred feet above, beeches grow. Still higher are yews, pines, and firs. Then comes the lote-tree, the birch, and the rhododendron. Higher still are daphnes, globularia, and the ligneous cistaceæ. In the snowy regions will be seen the saxifrages and the primroses. Last of all come the lichens.

9. The vegetation which is now feeble may in time become abundant and vigorous. Great changes are constantly going on. Marshes are becoming dry, and rocks, which are now bleak and bare, will hereafter, perhaps, sustain majestic trees. In swamps, the surface of the water is at first covered with a greenish scum. This consists of the frail plants called confervæ, to which succeed the sedge, the reed, and the reed-mace. Then follow the mosses, which multiply

with prodigious rapidity. As this vegetation goes on, the decaying matter gradually reduces the water, which at length disappears. And the case is similar with the rocks. Crustaceous lichens first cover their surfaces with marble hues. From the decomposition of these spring lichens of a different sort. Upon their remains, at a later period, the grasses take root; and at length from this ever-increasing vegetable mold rise the ligneous plants.

10. We have already remarked that among plants particular families inhabit particular regions. But there is one family—that of the cereal grains—which adapts itself to every clime. Admirable provision of that Providence which, when it gave the earth to man, determined that he should meet at every step with the evidences of its paternal and superintending care!

COUNT FŒLIX, "Flowers Personified."

THE VICTORIA REGIA.

1. WE re-entered the canoe, which, under the order of the major-domo, hugged the left bank until we came to a narrow inlet, up which we turned. Julio, to whom all the canals and lakes of the Ucayali were familiar, immediately recognized the entrance to the Nuña Lake, and asked our guide what we were going to do. "See the *atun sisac*," he said. Although I understood the Quichua words *atun sisac* to signify

A Canal full of Victoria Regia Lilies.

great flowers, they did not convey an idea of their family, of their shape, or color, and I was anxious to learn whether the flowers in question were worth the chance we underwent on their account of being devoured by mosquitoes, which, as we pushed farther into the canal, came around us in clouds which seemed to increase in density as we proceeded farther.

2. I had already been bitten by some thousands of these insects, and had crushed fifty or so, which was quite an insufficient vengeance, when Eustace called out in his broken voice, "Here we are!" I immediately stretched my head out of the canopy. The canal lay behind us. Directly in front stretched a sheet of water of so strange and marvelous an aspect that I was inclined to embrace the major-domo in gratitude for having spontaneously brought me to witness it. But, recalling the fetid odor of the man's breath, I repressed this inclination, and contented myself by expressing with a look and a smile the pleasure he had given me.

3. The waters of this lake were black as ink, and reflected neither the light of the sky nor the rays of the sun; it was about six miles in circumference, and was fringed by a thick curtain of vegetation. Its surface at certain parts was covered with *Nymphæa*, whose gigantic leaves were of a brownish-green tint (*vert-pralin*), which contrasted with the ruddy wine-color of their turned-up borders. Mingled with these leaves, magnificent flowers were in full blossom, whose petals, of a milky whiteness outside, were brightened inside with a dull-red tint, with center

markings of a darkish violet. These flowers—in consequence of their enormous development and the size of their buds, which resembled ostriches' eggs—might have been taken as representatives of an antediluvian flora. Quite a multitude of stilt-plovers, ibises, jacanas, anhunas, savacus, Brazilian ostriches, and spoonbills disported themselves on this splendid carpet, and added to the striking character of the scene, while serving as objects of comparison by which the observer could judge of the size of the leaves and flowers, which these birds shook by their movements without possessing sufficient weight to submerge them.

4. After having enjoyed the view of this brilliant example of intertropical vegetation, I became desirous of possessing a specimen. My men pushed the canoe into this network of leaves and flowers, and, with the help of a woodman's axe, I was able to detach a flower and a bud from their stout stems, which were covered with hairs three or four inches in length. The leaves of the plant, anchored to the bottom of the water by spiny stems the size of a ship's cable, resisted the combined efforts of my men, and I was compelled to cut one a few inches only below the surface. This leaf, perfectly smooth above, was divided below into a multitude of compartments, with subdivisions of very regular form, the lateral partitions of which, bristling with prickles, were one inch in depth. Laid out flat on the canopy of our canoe, this marvelous hydrophyte covered it entirely.

5. I passed nearly an hour standing up in the canoe, in order to examine, as a whole and in detail, this lake of black water and these white flowers, from which I could not take my eyes; then, having made a sketch of the place, I gave the order for our return to Schética-Playa, where I arrived with the leaf, the flower, and the bud which I had just secured, and of which I was prouder than old Demetrius Poliorcetes of a new city added to the list of his conquests.

6. On landing, I had two sticks arranged as a cross, on which I placed the leaf of the *Nymphæa*, and by means of which two men carried it to the camp. Julio preceded and made a way through the rushes with the blows of a saber. My vegetable trophy arrived without hindrance at its destination, and I hastened before the heat should have affected it to examine and describe its various parts. The weight of the still moist leaf, as ascertained by means of a steelyard which Eustace employed to weigh out the salt to his fishermen, was thirteen pounds and a half; its circumference was twenty-four feet nine inches three lines. The flower, which measured four feet two inches round, and of which the exterior petals were nine inches in length, weighed three pounds and a half. The bud weighed two pounds and a quarter. I deposited the flower and bud in a basket; I then cut the immense leaf into eight pieces, which I wrapped in paper in order to preserve them in the interests of science.

7. This work completed, I drew Eustace aside in order that my men might not overhear what I had to

say to him, and, having thanked him for the agreeable surprise he had given me, I announced to him the early departure of the reverend Plaza from Sarayacu, suggesting that he should not prolong his stay at Schética-Playa if he wished to receive the blessing of the future bishop. But this news, which I expected would have stupefied, upset, or even sobered him, only provoked his ridicule. He pretended that I wanted to make fun of him; and to show that it was he, Eustace—who, on the contrary, was amused with me—he looked at me askance, winked, and applied the bottle to his lips. To cut the matter short—as it signified little to me whether the man believed my statement or not—I left him to drink and wink at his ease, and, waving my hand by way of adieu, entered the boat, which soon stood off from Schética-Playa.

8. The giant *Nymphæa* we carried with us formed the subject of conversation for some minutes. According to Julio and his companions, certain lakes in the interior are so thickly covered with this plant that a boat can not make its way through the inextricable network of stalks and stems, crossed, interlaced, and bound together like the liana of a virgin submarine forest. As before stated, the riverside tribes of the Ucayali call this *Nymphæa* in Quichua *atun sisac* (the large flower). Among the Indians of the upper Amazon it goes by the name of *iapunauaopé;* among those of the lower Amazon by that of *jurupary-teañha;* and in the south, near the sources of the affluents of the right bank of this river, Guaranis, on whose territory it also flourishes, call it *irupé.*

9. This *Nymphæa*, of which the penetrating odor recalls at once that of the reinette-apple and the banana, appeared to me, from the resemblance in size and color, to be of the same genus as the *Nymphæa Victoria* or regia, found by Haëhne on the Rio Grande; by d'Orbigny, on the San José, an affluent of the Paraná; by Poeppig, in a pool (*igarapé*) of the Amazon; by Schomberg, in English Guiana; and lastly, by Bridges, on the Jacouma, a tributary of the Rio Grande.

10. In his monograph on European hothouse plants, Van Houte, who has painted and described this splendid *Nymphæaceæ*—of which the Jardin des Plantes, in Paris, possesses a specimen in its aquarium—has painted the exterior petals of the flower a pure white; those which immediately succeed are of a delicate pink tint; while, as the center is reached, they display a uniform China-rose color, of an intensity and brilliancy very different from the dull pink and violet tints of the flower found by us on the Lake Nuña. We may point out, in passing, that the geographical habitat of this plant, which extends from the Ucayali to the Teffé and from English Guiana to the plain of Moxos, adds still more to the surprise and admiration which are awakened by its extraordinary dimensions.

PAUL MARCOY, "Travels in South America."

THE ARAB TO THE PALM.

1. Next to thee, O fair gazelle,
O Beddowee girl, beloved so well;

2. Next to the fearless Nedjidee,
Whose fleetness shall bear me again to thee;

3. Next to ye both, I love the palm,
With his leaves of beauty, his fruit of balm;

4. Next to ye both, I love the tree
Whose fluttering shadow wraps us three
With love and silence and mystery!

5. Our tribe is many, our poets vie
With any under the Arab sky;
Yet none can sing of the palm but I.

6. The marble minarets that begun
Cairo's citadel-diadem
Are not so light as his slender stem.

7. He lifts his leaves in the sunbeam's glance,
As the Almehs lift their arms in dance—

8. A slumberous motion, a passionate sign,
That works in the cells of the blood like wine.

9. Full of passion and sorrow is he,
Dreaming where the beloved may be;

10. And when the warm south winds arise,
He breathes his longing in fervid sighs,

11. Quickening odors, kisses of balm,
That drop in the lap of his chosen palm.

12. The sun may flame, and the sands may stir,
But the breath of his passion reaches her.

13. O tree of love, by that love of thine,
Teach me how I shall soften mine!

14. Give me the secret of the sun,
Whereby the wooed is ever won!

15. If I were a king, O stately tree,
A likeness, glorious as might be,
In the court of my palace I'd build for thee;

16. With a shaft of silver, burnished bright,
And leaves of beryl and malachite;

17. With spikes of golden bloom ablaze,
And fruits of topaz and chrysoprase;

18. And there the poets, in thy praise,
Should night and morning frame new lays—

19. New measures, sung to tunes divine;
But none, O palm, should equal mine!

BAYARD TAYLOR.

THE LIFE OF PLANTS.

1. In the harmony of the spheres, everything is in a state of mobility and perpetual transmutation. The heavens are tenanted with new nebulæ, and old stars disappear in the abyss of immensity. On the earth new generations of animals and plants arise, while the scythe of Time mows down those which but lately flourished there. On the one hand, the mass of animated matter visibly reveals its vitality; while, on the other side, its occult forces hide themselves and act only in the most hidden recesses of the organism. But all is carried away by the supreme power of life—that inexplicable and unfathomable mystery!

2. We behold animals which at a certain season, and at a given moment, display themselves in irresistible power, or disappear, providentially guided by an unknown force. Sometimes it seems as if a ray of light attracted them, while darkness drives them away; at other times it is the reverse.

3. When night begins to spread its somber shades over the earth, legions of twilight-loving moths flit heavily near their haunts, while the bat, issuing from its ruins, shakes its membranous wings and launches itself in pursuit of these insects. Some delicate mollusks rise toward dawn to the surface of the sea, and sink beneath its waves so soon as ever the sun gilds its undulating ripples.

4. Again, we behold plants or their corollas displaying themselves and opening according to the sea-

Coffee Picking in Guatemala.

sons and hours of the day. So exact are they in their movements that a sagacious observer, attentively following up these phenomena, soon sees that by means of them he can arrange calendars and clocks, all the divisions of which the charming goddess of flowers indicates accurately with her finger.

5. It is known that Pliny, having noted with care the times at which plants flower, conceived the idea that we might make use of them to mark the different seasons of the year. Cuvier even asserts that the Roman naturalist proposed to arrange a complete floral calendar; but the project was first thoroughly carried out by Linnæus, and it is one of the most elegant conceptions of his genius.

6. This floral calendar is accurate enough, and we can see that each month of the year is exactly indicated by the blooming of certain flowers. The first month, despite its snow and ice, sees the black hellebore flower. During the second the alder shakes its catkins and the mezereon seems to smile on the spring, scattering its flowerets over its boughs. In March the wall-flower decorates the old walls with its golden corollas, and in our gardens the crown-imperial opens its treacherous bells. The following month the periwinkle expands its leafy network in the shadow of our forests. In May, flowers abound; the iris, the lily of the valley, and the lilac perfume the air on every side. During the months of June and July Flora parades all the pomp of her empire; the foxglove, the sage, the wild poppy, the mint, and the pink bloom in our fields and woods. In August, the

asters, dahlias, and helianthus seem to brave the heat of the sun. Finally, in September, the colchicum scatters its purplish flowers all over our meadows, and announces the return of winter. It is the plant which, according to Linnæus, gives the signal of repose to the botanist.

7. The hour at which each flower opens is itself so uniform that by watching them floral clocks of sufficient accuracy can be arranged. Father Kircher had dreamed of it, but vaguely and without pointing out anything; it is to Linnæus that we must ascribe the ingenious idea of indicating all the hours by the time at which plants open or shut their corollas. The Swedish botanist had created a flower clock for the climate which he inhabited, but, as in our latitudes a more brilliant and radiant dawn makes the flower earlier, Lamarck was obliged to construct for France another clock, which is a little in advance of that at Upsala.

8. This regularity in the opening of flowers strikes every person; some savage races make use of it to divide their days and their toils. These begin at the hour when the marigold opens, and the Natchez, Chateaubriand says, make their love appointments for the time when the last rays of day are about to close the flowers of the Hibiscus.

9. Other flowers, less regular in their habits, only open under the influence of certain atmospheric conditions, from which they have acquired the surname of meteoric. Some of them have gained considerable celebrity. Among these is the rain-marigold,

which, so soon as the dark clouds begin to gather, closes its corolla with the greatest care to preserve it from the storm. The Siberian sow-thistle, of totally different habits, accustomed to hoar-frost, seems to dread our sun; it only expands when the sky is cloudy, and closes its flowerets tightly up as soon as the atmosphere gets warm.

10. The connection between man and the vegetable kingdom is not limited to these curious investigations; plants, living emblems of the rapid passage of hours and time itself, eternal lessons of wisdom, are associated with all our wants, our pleasures, and our pains. The hardiest trees serve to build our dwellings with; other plants form our most natural food.

11. Sometimes the existence of certain tribes depends on a single vegetable species. A palm which grows in the forests at the mouth of the Orinoco suffices for all the wants of some savage races, who, in company with the monkeys, live almost constantly perched, as it were, in the midst of its foliage. It yields them food, wine, and even cordage to swing the hammocks on, in which they suspend themselves during the inundations.

12. In all ages men have prized the beauty and perfume of flowers, and they have become an indispensable ornament of even the least important festival. The ancients had their "coronary plants"; these were consecrated to Venus, and at feasts each guest wore a chaplet. But we must also do them the justice to remark that they employed an ample series

of "funereal plants" for the mournful ceremonies of death; each one had its mission or special signification.

F. A. Pouchet, "The Universe."

SEA-WEEDS.

1. On the rocky coasts of the Falkland Islands are found astonishing masses of enormous sea-weeds, chiefly belonging to the genera *Macrocystis*, *Lessonia*, and *Durvillea*. Rent from the rocks to which they were attached and cast ashore, they are rolled by the heavy surf into prodigious vegetable cables, much thicker than a man's body and several hundred feet long. Many of the rarest and most beautiful algæ may be here discovered, which have either been wrenched from inaccessible rocks far out at sea, along with the larger species, or have attached themselves parasitically to their stems and fronds. Many of them remind the botanist, by some similarity of form, of the sea-weeds of his distant home, while others tell him at once that he is far away in another hemisphere. The gigantic lessonias particularly abound about these islands. Their growth resembles that of a tree. The stem attains a height of from eight to ten feet, the thickness of a man's thigh, and terminates in a crown of leaves two or three feet long, and drooping like the branches of a weeping-willow. They form large submerged forests, and, like the

thickets of the macrocystis, afford a refuge and a dwelling to countless sea-animals.

2. A similar abundance of colossal algæ is found in the northern Pacific, about the Kurile and Aleutian Islands, and along the deeply indented and channel-furrowed northwest coast of America.

3. Thus the *Nereocystis lutkeana* forms dense forests in Norfolk Bay and all about Sitka. Its stem, resembling whipcord, and often above three hundred feet long, terminates in a large air-vessel, six or seven feet long, and crowned with a bunch of dichotomous leaves, each thirty or forty feet in length. Dr. Mertens assures us that the sea-otter, when fishing, loves to rest upon the colossal air-vessels of this giant among the sea-weeds, while the long, tenacious stems furnish the rude fishermen of the coast with excellent tackle. The growth of the nereocystis must be uncommonly rapid, as it is an annual plant, and consequently develops its gigantic proportions during the course of one brief summer.

4. Before proceeding to the third chief group of marine plants, the red sea-weeds, or *Rhodosperms*, I must mention the enormous fucus banks, or floating meadows of the Atlantic, which form undoubtedly one of the greatest wonders of the ocean.

5. We know that the mighty Gulf Stream, which rolls its indigo-blue floods from America to the opposite coasts of the Old World, flows partly southward in the neighborhood of the Azores, and is ultimately driven back again to America. In the midst of these circuitous streams, from 22° to 36° N. lat., and from

35° to 65° W. long., extends a sea without any other currents than those resulting from the temporary action of the winds. This comparatively tranquil part of the ocean, the surface of which surpasses at least twenty times that of the British Isles, is found more or less densely covered with floating masses of *Sargassum bacciferum*. Often the sea-weed surrounds the ship sailing through these savannas of the sea in such quantities as to retard its progress, and then again hours may pass when not a single fucus appears. While Columbus was boldly steering through the hitherto unknown fields of the Sargasso Sea, the fears of his timorous associates were increased by this singular phenomenon, as they believed they had now reached the bounds of the navigable ocean, and must inevitably strike against some hidden rock, if their commander persevered in his audacious course.

6. It is an interesting fact that the Sargasso Sea affords the most remarkable example of an aggregation of plants belonging to one single species. Nowhere else, according to Humboldt, neither in the savannas of America, nor on the heaths or in the pine forests of northern Europe, is such a uniformity of vegetation found as in those boundless maritime meadows.

7. "The masses of sea-weeds," says Meyen, "covering so vast an extent of ocean have ever since the time of Columbus been the object of astonishment and inquiry. Some navigators believe that they are driven together by the Gulf Stream, and that the same species of Sargassum plentifully occurs in the Mexican Sea; this is, however, perfectly erroneous.

8. "Humboldt was of opinion that this marine plant originally grows on submarine banks, from which it is torn by various forces; I, for my part, have examined many thousands of specimens, and venture to affirm that they never have been attached to any solid body. Freely floating in the water, they have developed their young germs, and sent forth on all sides roots and leaves, both of the same nature."

9. Thus the Sargassum seems to be the indigenous production of the sea where it appears, and to have floated there from time immemorial. Its swimming islands afford an abode and nourishment to a prodigious amount of animal life. They are generally covered with elegant sertularias, colored vorticellas, and other strange forms of marine existence. Various naked or nudibranchiate mollusks and annelides attach themselves to the fronds, and afford nourishment to hosts of fishes and crustaceans, the beasts of prey of this little world.

10. Similar aggregations of sea-weeds are also met with in the Indian and Pacific Oceans, in the comparatively tranquil spaces encircled by rotatory currents. Their rare occurrence on the surface of the sea may serve as a proof of the restless motion of its waters. Were the ocean not everywhere intersected by currents, it would most likely be covered with sea-weeds, opposing serious if not invincible obstacles to navigation.

11. The red sea-weeds (*Rhodosperms* or *Florideæ*) are by far the most numerous in species, and undoubtedly the most beautiful and perfect of all the

algæ. They love neither light nor motion, and generally seek the shade of larger plants on the perpendicular sides of the deep tide-pools removed from the influences of the tides and gales. They mostly grow close to low-water mark, and are to be seen only for an hour or two at the spring tides, during which, as is well known, the deepest ebbs take place. To this group belong the wonderfully delicate polysiphonias, callithamnias, plocamias, and delesserias, whose elegant rosy scarlet or purple leaves are the amateur's delight, and when laid out on paper resemble the finest tracery, defying the painter's art to do justice to their beauty. It likewise numbers among its genera the chalky corallines and nullipores, which on account of the hardness of their substance were formerly considered to be polyps, but whose true nature becomes apparent on examining their internal structure.

12. The *Chondrus crispus*, or carrigeen, which grows in such vast quantities on the coasts of the British Isles, also belongs to the rhodosperms, though when growing, as it frequently does in shallow tide-pools, exposed to full sunlight, its dark-purple color fades into green or even yellowish white. When boiled it almost entirely dissolves in the water, and forms on cooling a colorless and almost tasteless jelly which of late years has been largely used in medicine as a substitute for Iceland moss. Similar nutritious gelatines, which also serve for the manufacture of strong glues, are yielded by other species of rhodosperms, among others by the *Gracillaria spinosa* of the Indian Ocean, which the Salangana (*Hirundo escu-*

lenta), a bird allied to the swallow, is said principally to use for the construction of her edible nest.

G. HARTWIG, "The Sea and its Living Wonders."

AN AUTUMN GARLAND.

1. SUNNY, golden autumn, after the glaring heats of midsummer, how welcome! Spring nor summer can not match these charming September mornings and October afternoons. The sun runs high no longer, but comes in aslant under the trees and lights up everything with a golden glow. We are glad the tropic heat is past; but we stretch out our hands and try to grasp the delicious warmth of this autumn weather, fearing it will not last. Yet we have to thank that fervent summer sun for all which gladdens us now—these wide emerald fields, these leafy bowers, this rich luxuriance of fruit. It was that sultry fervency that brought the green into the leaves, and the gay colors to the flowers, and the soft ripeness into the fruit. Kindly fall the slanting rays now, greeting the nodding golden-rod, purpling the grapes upon the wall, giving another warm touch to the red sides of the apples, another yellow glow to the pumpkins and squashes.

2. How beautiful are the rich landscapes spread out before our eyes! Joseph's coat of many colors is outvied by the variegated hues of field and forest.

There is a splendor, an imperial royalty in our northern autumn which makes the other seasons seem tame. There is an appropriateness, a fitness, in the ancient symbol which gives to winter the form of a stern Titan, to spring the lithe robustness of an Apollo, to summer the grace of a Hebe, while autumn has the majesty and maturity of a Juno. Autumn *is* queen of the seasons, a tiara-crowned empress, whose glowing robes of red and purple and saffron rival all the vaunted products of Babylonian or Tyrian looms. She reigns supreme, and in her realm are perpetual rest and beauty and tenderness.

3. There is no exhausting heat, no burning sunshine, as we wander, forth into the "happy autumn fields." The grass is still soft and green, the vines are still hanging in full, rich clusters along the roadsides. From the orchards float a sweet-apple odor. Tall cat-tails stick up their sceptered heads from the brookside, and the drooping, fleecy Clematis clamber the fences and hedges. Golden-rods, the same that peered over the stone walls in the last days of August, yet nod to us in these still, October days, climbing up higher and higher in a thick tangle of greenness, for these autumn flowers do not hurry away as did the delicate anemones—the wind-flowers—opening to the breeze, then floating off upon its zephyrs. They are all stout, vigorous herbs that do not care when the warm days of September give way to chill and cold, and the bright afternoons suddenly fall into damp evenings. And these fall afternoons are short, though charming; the sun sinks down at

once, and it is night before we are aware the day is gone.

4. But our wandering has not been in vain. Our arms are full of drooping vines, bright colors, and feathery waves—wild-flower spoils of the fields and the woods—which we weave into a beautiful garland that has all the mellowness of the autumn days together with their brilliant coloring. Here is a bunch of fringed gentians with their corollas—

> "Blue, blue, as if the sky let fall
> A flower from its cerulean wall,"

as Bryant sings, though, indeed, the color is of a purpler tinge than the sky. This particular bunch we gathered on the border of a hillside road, shut in by a sandy slope, where the sun shone warmly. The flower grows on a tall footstalk, with a long, bell-shaped calyx, out of which press its fringed edges. It is a coy, maidenly flower only coming to its finder after diligent search; but one feels repaid. There are several varieties of the gentian in this region, and all are pretty.

5. In this autumn bouquet we have arranged many bright-colored berries which are now among the most noticeable glories of the hedges and meadows. There are the orange and scarlet berries of the bitter-sweet (Celastrus), whose leaves have a fresh, yellowish, springlike greenness till late into the fall. Sandwiched between these are the milk-white berries of the cohosh, or white baneberry, and the black-purple fruit of the elder; then come the deep-red seeds of the

dwarf cornus, sometimes called bunch-berries, each set, as the flower was, in a frame made by four or five oval leaves; and, when we can find them, baneberry plumes, which are among the finest of all the autumn splendors, the red juice deepening into coral berries that glow all along its leaves and cause the branch to droop gracefully like a plume.

6. Golden-rods in bewildering variety glow in our lovely garland—all beautiful and stately as a czarina. Some of these shoot up into tall plumes; others hang gracefully, the flowers rising from the upper side of the stalk in clusters. The leaves, too, of the different varieties differ in shape. There are a dozen species in this bunch, the search for which has led us along pleasant lanes and hedges in the dreamy autumn afternoon.

7. Closely allied to the golden-rods are the Asters—a sort of cousins, in fact—both belonging to the great family of *Compositæ*. These are now in their season of glory, more than one hundred species being found in America, all gay and showy, with corymbed, panicled, or racemose heads; flowers radiate, the rays white, purple, or blue and fertile, the disk yellow or reddish. In the garden Asters the disk flowers give place to repeated series of ray flowers, and assume the appearance of the well-known China Asters. They bloom till very late; long after the other flowers have yielded to the touch of frost gay beds of Asters can be seen looking as fresh and joyous as though it were yet summer.

8. Among the glories of the garden in these late days are the Dahlias. Stately, stiff, ceremonious duennas, they are suggestive of the old days of ruffs and starched petticoats, when court beauties in jeweled stomachers and fardingales assembled round the "Virgin Queen," starched and bestomached more than any of them. In those days, however, the Dahlia did not frequent royal courts, unless, indeed, it gazed wonderfully on Aztec or Peruvian magnificence in the nut-brown hands of some dusky maid of Montezuma's court or the Inca's Palace of the Sun. For this plant is of tropic origin, and was first introduced into Europe by Alexander von Humboldt in 1790. It has since been successfully cultivated by many gardeners on both sides of the sea. The flowers of all the species are distinguished by the absence of a pappus and by a double involucre, the outer being many-leaved, and the inner consisting of one leaf divided into eight segments. Their showy bloom lasts through all October, if protected from hard frosts.

9. Then there are the delicate yellow, late-appearing blossoms of the Madeira vine, which with its shining, graceful leaves are very attractive. The last of the Clematis, a great bough, all fleecy white, contrasts finely with the rest, and is no little addition to the floral wreath. How I wish I could keep it forever, this garland of ours; but no, it must fade and perish just like the beautiful autumn itself. It is no fairy princess to go to sleep and remain the same for a hundred years. I pick my last aster with sorrowful regret, knowing that against all this bed of varie-

gated color will soon only be a dull, blank whiteness. All too soon my autumn bouquet will be a thing of the past.

F. M. Colby, "The Ladies' Floral Cabinet."

THE GIANT TREES OF CALIFORNIA.

1. These trees are about thirty miles from the Yosemite Valley and two hundred and thirty from San Francisco.

2. Six hundred of these mammoths are scattered among the noble pines of twelve hundred and eighty acres. Many of the pines are two hundred feet high. Elsewhere they would be kings of the forest; but among these hoary giants they become puny, insignificant children. Pygmies on Alps may be pygmies still, but pyramids are not always pyramids in vales.

3. The Big Trees have been considered redwoods —a species of cedar abounding on this coast—but the botanists decide otherwise, and name them Sequoias. They are the oldest and most stupendous vegetable products existing upon the globe. Already twenty groves have been discovered in California. The Mariposa is the largest and finest, though the Calaveras, fifty miles to the northward, is better known.

4. Of the Mariposa Sequoias, two hundred are more than twelve feet in diameter, fifty more than sixteen feet, and six more than thirty feet. The largest, called the Prostrate Monarch, now lying upon

the ground leafless and branchless, is believed to have fallen fully one hundred and fifty years ago! Fire has consumed much of the trunk, but enough remains to show that with the bark on, it must have been forty feet in thickness. Figures give little idea of such dimensions. Measure up forty feet on a house wall, then four hundred feet along the ground, and try to picture the height and diameter of the Prostrate Monarch as it stood a thousand years ago!

5. The tops of the largest trees are broken off, leaving their average height about two hundred and fifty feet, though some range between three and four hundred feet. We saw one with a branch—not a fork, but an honest, lateral branch—six feet in diameter, growing from the stem eighty feet above the ground.

6. Into a cavity burned in the side of another standing tree fifteen of us rode together. Without crowding, we all sat upon our horses in that black, novel chamber, though it occupied less than half the thickness of the immense trunk.

7. Through a stem lying upon the ground fire has bored like an auger. Our entire cavalcade, including all the tall men, all the fat men, and all the ample skirts, rode through it from end to end, like a railway train through a tunnel. One enormous living trunk parts near the ground into two tall, systematic, perfect stems.

8. The largest standing tree is the Grizzly Giant. Its bark is nearly two feet thick. If it were cut off smoothly, fifty horses could easily stand or sixteen

couples dance upon the stump. If the trunk were hollowed to a shell, it would hold more freight than a man-of-war or a first-class steamer two hundred and fifty feet long.

9. One of the Calaveras Sequoias was cut down by boring with augers and sawing the spaces between. The work employed five men for twenty-five days. When fully cut off the tree stubbornly continued to stand, only yielding at last to a mammoth wedge and a powerful battering-ram. . . . There seems to be no convincing or even plausible theory of their origin—I should rather say of their preservation, for they are children of a long-ago climatic era. The age of giants lingers on the entire Pacific coast. . . . It was once thought incredible that the yew should live a thousand years. But these monster Sequoias are the world's patriarchs.

10. Some botanists date their birth far back of earliest human history; none estimate their age at less than eighteen hundred years. Perchance their youth saw the awkward thundering mastodon canter over the hills, and the hundred-feet-long reptile of many legs, and mouth like a volcano, crawl sluggishly through torrid swamps. They were living when the father of poets, old, blind, and vagabond, sang his immortal song; when the sage of Athens, "that most Christian heathen," calmly drank the hemlock; when the carpenter of Judea, from whom the whole world now computes its time, was a man of sorrows and acquainted with grief, despised and rejected of men.

11. An act of Congress has segregated Yosemite

The "Grizzly Giant."

Valley and the Mariposa groves of Big Trees from the general public domain, setting them apart as pleasure grounds for the people of the United States and their heirs and assigns forever.

A. D. RICHARDSON, "The Sublime in Nature."

MOUNTAIN VEGETATION.

1. VEGETATION changes with the latitude—that is to say, according to the distance of the equator. As we advance from the equator toward the poles we meet in succession with the equatorial, tropical, temperate, and polar zones—vegetation gradually losing its power, a fact which is proved most satisfactorily by the decreasing number of species and by their dwarfed appearance until vegetation altogether ceases in the region where snow reigns eternal. When heat disappears, organic life is extinguished, and vegetable organization is subject to the same laws and experiences loss of power and vigor proportioned to the decrease of heat.

2. But a natural reflection presents itself immediately as a corollary upon these remarks.

3. When we ascend a mountain, or, in fact, when we ascend by any means whatever—in a balloon, for instance, as M. Glaisher's experiments seem to show —the temperature decreases by something like one degree for every hundred yards above the surface. It follows from these premises that every stage in the

ascent of a mountain should exhibit different forms of vegetation, each forming a zone or botanic region similar to those we have passed in tracing their geographical latitudes. And this is so, in fact, as we shall find in the following remarks, which we borrow from the writings of Adrian de Jussieu on the vegetation of the Alps and Prof. C. Martins on Mont Ventoux, in Provence:

4. "Let us imagine a spectator at the foot of the Alps," says M. de Jussieu, "opposite to one of those grand rocky masses crowned with eternal snow. As his eye ranges along the sides of the mountain he observes that the vegetation which immediately surrounds him, and which is that which characterizes central and northern France, disappears at a certain height, giving place to another, which in turn disappears at a higher range. Beyond a certain distance the eye can only seize the masses indicated by large trees, the humbler plants being concealed behind them, so that they look like a series of bands superposed one over the other on the slopes of the mountain. At first these belts are composed of deciduous-leaved plants, which drop early and are readily distinguithable by their more tender verdure; then conifers of deeper green, which in the mass appear nearly black. Another belt succeeds of an undecided green, interrupted here and there by clumps of another color, which goes straggling up to the sinuous line where the snow commences. This is owing to the circumstance that the trees whose branches are too closely intermingled have died out, making room

for shrubs or herbaceous plants more dwarfed in their growth and more on a level with the soil.

5. "If the spectator approaches the mountain and scales it, he will find other plants very different from the masses he looked at in the distance, which we call Alpine plants—such as the aconites, astrantia, certain species of artemisias, of groundsel, prenanthes, achilleas, saxifrages, and potentillas. After having skirted the walnut-trees and traversed the woods formed of chestnut-trees these will be observed to cease, and forests of oak, beeches, and birches take their place. Of these, the oaks disappear first, at the height of about twenty-five hundred feet above the level of the sea, the beeches about three thousand feet. Beyond this the trees consist entirely of evergreens, as firs, larches, and the common pines, which stop also at certain successive stages, about forty-five hundred feet. The birch ascends a little higher, but disappears also at about six thousand feet of elevation. A conifer (*Pinus cembra*) continues for another hundred yards. Beyond this limit the trees become dwarfed in size; for example, a species of alder (*Alnus viridis*) becomes a low shrub. Near to this the botanist will find himself surrounded by shrubs very characteristic of the Alps, sometimes called the Alpine rose, namely, the rhododendron, which ceases in its turn only a little higher, giving place to plants much more lowly, which scarcely rise above the soil. These are specially known as Alpine plants. They belong to families which he observed at his point of departure—a few crucifers, caryophyllum, *Rosaceæ*,

Leguminosæ, *Compositæ*, *Cypriaceæ*, *Gramineæ*, but of different species. These also are numerous, and with them representatives of other families which rarely show themselves in the plains, such as saxifrages and gentians. Annuals cease almost entirely, as might be foreseen, since an unfavorable season, in which the ripening of their seeds was checked, would be sufficient to destroy their race."

6. The roots of the perennial or woody plants bury themselves under the soil, where a higher temperature is preserved. They submit to the influence of the atmosphere, and develop when it is milder and sufficiently warm. But this can only be done during a short season, and on some places only once in many years. It follows that the stems are short and scarcely rise out of the soil, while those that are frutescent usually hug the ground, sometimes creeping, sometimes rising short, hardy, intertwining stems, forming thick, stunted bushes, as would result in ordinary cases from pruning shrubs very near the ground. The general appearance proper to the plant is thus effaced in some respects and replaced by the physiognomy belonging to Alpine vegetation. These plants are generally of the arborescent kind, like the willows, whose roots creep along the ground. The more elevated they are, the more scattered and impoverished is the vegetation, until, at the foot of the rocks, it only appears in the form of lichens, whose crust differs from the monotonous tint of their own surface. When the limit of eternal snow is reached, organized life can no longer exist.

7. Mont Ventoux, in Provence, presents us with an interesting application of the same facts. This mountain rises abruptly from a plain, the temperature of which may be compared with that of Sienna, Brescia, or Venice, while the summit of the mountain approaches the climate of Sweden, on the borders of Lapland. To ascend its sides and reach the summit is as if we had actually traversed nineteen degrees of latitude, or from 44° to 63°. Prof. Charles Martins has published an interesting account of the vegetation of this mountain. "Mont Ventoux," says the learned professor of Montpellier, "presents a succession of well-defined botanical regions, each characterized by the presence of plants which are wanting on the others. These regions are six in number upon the southern slopes and five on its northern side.

8. "Ascending the southern slope, its base, in respect to its vegetation, is like that of the valley of the Rhone. All the plants of the plains are found in the region at the foot of the mountain, and they are well characterized by two trees—the Aleppo pine and the olive. Both belong to the basin of the Mediterranean, round which they form a girdle, only interrupted by the Delta of the Nile. The Aleppo pine is found upon all the hills which lie at the southern foot of Mont Ventoux, but ceases at the height of fourteen hundred feet above the level of the sea. The olive ascends a little higher, but ceases at sixteen hundred feet. Under these trees we meet with all the species which characterize the vegetation of Provence—the Kermes oak, the rosemary, the Span-

ish broom, and *Dorycinium suffraticasm.* A narrow zone, scarcely exceeding a hundred and eighty feet, succeeds to this, which is characterized by the evergreen oak. Among the undershrubs we find the European leadwort, the juniper, the great *Euphorbia characias*, and the Psoralea, of bituminous odor.

9. "A region altogether destitute of arborescent vegetation follows. The soil is here naked, stony, and generally uncultivated; nevertheless, here and there fields of chick peas, oats, and barley appear, the last of which disappears at thirty-five hundred feet above the Mediterranean; but a shrub—the box-tree—two undershrubs — thyme and lavender — another herbaceous *Labiatæ* (*Nepeta graveolens*), and the swallow-wort (*Vincetoxicum officinale*) predominate as to size and number. It is at this point that the first indications of an arborescent vegetation appear, but it is necessary to ascend to thirty-eight hundred feet before reaching the new vegetation. It is composed of beeches; at first sparse and undersized, they get larger three hundred feet higher, especially in the deep ravines and valleys, where they are sheltered from the wind. This region extends as high as fifty-five hundred feet. At this height the depressions are slight, valleys and ravines almost cease, and the trees are exposed to the depressing action of the winds. The plants which clothe the soil are now humble bushes, with short, hard, and crowded branches. One of these bushes, like a large ball or mattress extended on the earth, is often as old as the great beeches which elevate their proud heads to the

heavens in the valleys below. Numerous species occupy the region of beeches, many of them belonging to the subalpine zone of the mountains of central Europe, never descending into the plains, unless transplanted. Such are the buckthorn, the gooseberry, the wallflower, the mountain sorrel, and the mountain anthyllis.

10. "At the height of fifty-six hundred feet the cold is intense, the summer brief, and the wind so violent that the beech can no longer exist. As upon Mont Ventoux, so it is on the Alps and Pyrenees—on all, a tree of the family of Conifers is the last representative of arborescent vegetation. It is a humble species of pine, called the mountain pine (*Pinus uncinata*), because the scales of its cone are curved into a sort of claw. These pines are found many feet in height in sheltered places, but become mere bushy shrubs when exposed to the sweep of the winds. They ascend as high as six thousand feet, the extreme limit of arborescent vegetation. The herbaceous plants of this region are the same as in the region of beeches, which nearly all attain the limit of the pines. In addition to the common juniper, resting on the soil, as it always does on high mountains, where the weight of the snow crushes it all the winter, we find the mountain germander (*Veronica montana*) and the tufted saxifrage (*S. cæspitosa*), which is found on the loftiest ridges of the Alps.

11. "Its flora thus teaches us, in the absence of the barometer, that we have reached the Alpine re-

gion of Mont Ventoux, and that the region of arborescent vegetation has disappeared. But here the botanist will be delighted to find the flora of Lapland or Iceland and of Spitzbergen also. In the Alps this region extends to the line of perpetual snow, the home of eternal winter. But as Mont Ventoux is only six thousand three or four hundred feet high, the summit only extends to the lower zone of the Alpine regions in the Alps and Pyrenees. At this point all trees have disappeared, but a crowd of small plants expand their corollas on the stony surface. Among them the orange-flowering poppy, the violet of Mont Cenis, the blue-flowered astragalus, and, quite at the summit, the meadow grass of the Alps, Gerard's *Euphorbia*, and the common nettle, which is generally found wherever man fixes his dwelling.

12. "A chapel has been built on the summit of the mountain since the ascent of Petrarch. But it is not on the south terminal summit that the botanist will seek for the Alpine plants characteristic of the loftier regions. It is on the northern declivities, on the rocks exposed to the glacial north winds, nearly deprived of the sun during long months and covered with snow from June. These I have surveyed as I would survey an old friend. The purple saxifrage (*S. oppositifolia*) was the first plant I recognized; I had gathered it on the summit of the Reculet, the loftiest ridge of the Jura, and upon all the summits of the Alps which reached or passed the limits of perpetual snow. When I put foot for the first time on the icy shores of Spitzbergen the

purple saxifrage was among the first plants which attracted my attention; for here are found, on the shore of the sea, the cold summers and the melting snow of the summits which crown the Alps and the Pyrenees. Upon Mont Ventoux other saxifrages, equally Alpine, surround it. The blue bell-shaped flowers of *Campanula Allioni* raised their heads from a heap of stones and dwarf plants which covered all these heights; the round-headed phyteuma, the hairy androsacea, the ononis of Mont Cenis, and three species of arenaria clung to the rocks or peeped through the stones."

LOUIS FIGUIER, "The Vegetable World."

INDIAN SUMMER.

1. WHEN leaves grow sear all thing take somber hue;
   The wild winds waltz no more the woodside through,
   And all the faded grass is wet with dew.

2. A gauzy nebula films the pensive sky,
   The golden bee supinely buzzes by,
   In silent flocks the bluebirds southward fly.

3. The forest's cheeks are crimsoned o'er with shame,
   The cynic frost enlaces every lane,
   The ground with scarlet blushes is aflame!

4. The one we love grows lustrous-eyed and sad,
With sympathy too thoughtful to be glad,
While all the colors round are running mad.

5. The sunbeams kiss askant the somber hill,
The naked woodbine climbs the window-sill,
The breaths that noon exhales are faint and chill.

6. The ripened nuts drop downward day by day,
Sounding the hollow tocsin of decay,
And bandit squirrels smuggle them away.

7. Vague sighs and scents pervade the atmosphere,
Sounds of invisble stirrings hum the ear,
The morning's lash reveals a frozen tear.

8. The hermit mountains gird themselves with mail,
Mocking the thrashers with an echo flail,
The while the afternoons grow crisp and pale.

9. Inconstant Summer to the tropics flees,
And, as her rose-sails catch the amorous breeze,
Lo! bare, brown Autumn trembles to her knees!

10. The stealthy nights encroach upon the days,
The earth with sudden whiteness is ablaze,
And all her paths are lost in crystal maze!

11. Tread lightly where the dainty violets blew,
Where the Spring winds their soft eyes open flew;
Safely they sleep the churlish Winter through.

12. Though all life's portals are indiced with woe,
And frozen pearls are all the world can show,
Feel! Nature's breath is warm beneath the snow.

13. Look up, dear mourners! Still the blue expanse,
Serenely tender, bends to catch thy glance;
Within thy tears sibyllic sunbeams dance!

14. With blooms full-sapped again will smile the land:
The fall is but the folding of His hand,
Anon with fuller glories to expand.

15. The dumb heart hid beneath the pulseless tree
Will throb again; and then the torpid bee
Upon the ear will drone his drowsy glee.

16. So shall the truant bluebirds backward fly,
And all loved things that vanish or that die
Return to us in some sweet by-and-by.

ANONYMOUS.

THE SLEEP OF PLANTS.

1. THE deeper we search into the mysteries of vegetable life the closer relation do we find with animal existence. Exhausted by the functional labor of the day, many plants, when the evening arrives, assume a particular attitude, which they preserve through the night; this is their sleep.

2. This curious phenomenon, which a fortunate accident revealed to Linnæus, was carried by him to demonstration. He first observed it in a bird's-foot lotus growing in one of the greenhouses of the garden at Upsala. Having noticed it flowering in the morning, what was his astonishment, as he passed by the plant in the middle of the night, to find that he could not see its flowers! At first the botanist thought that some unprincipled amateur had robbed him of them; but, on looking more attentively at the plant, he found that it was against itself the charge of larceny would have to be preferred. In fact, the naturalist observed that each evening the leaves of this lotus assumed a particular position which hid the corollas; it was their way of sleeping.

3. Thinking that such a phenomenon would not be an isolated one, Linnæus after this passed the nights in wandering about in his garden, with a torch in his hand to verify the results. In this way he noticed that a great number of plants assume a particular attitude when they give themselves up to sleep. This is due to their need of repose, which, as in most animals, coincides with the want of light.

4. In certain families of the vegetable kingdom the plants are even so transformed during their sleep that they are not recognizable. The aspect of a forest or a savanna is sometimes absolutely changed by it. Many bring their boughs nearer to the stem, and apply their leaves one to the other, so as to be a mutual protection against the cold. Whoever has seen a sensitive-plant during the night, with its boughs

drooping, and, as it were, overpowered by fatigue, with its leaflets folded together like eyelids which close, will admit that at such times it rests and sleeps.

5. The phenomenon we are speaking of is seen in a much more striking form in hotter countries. Humboldt, while traversing the banks of the Magdalena, observed that there plants awake much later than in less torrid countries, as if vegetation in these climates shared in the indolence which is observable in all the peoples scattered beneath the equator.

6. Many flowers close every evening in order to give themselves up peacefully to repose. There are some, such as certain bindweeds, which are very lazy, falling asleep long before sunset, and only rousing up very late each morning, when the sun darts his rays upon them.

7. In the evening if we view a meadow in which these impressible flowers abound, its mournful aspect renders it unrecognizable. In full midday, when it is enameled with all these open corollas, it seems a mass of verdure filled with great yellow and blue eyes which gaze at us. But when twilight arrives all these seem to have closed their eyelids in order to slumber; the living aspect of the meadow has vanished; all appears inanimate—its flowers are sleeping.

8. Men have sought to attribute the phenomenon we are speaking of to the difference between the temperature of the day and the temperature of the night; but when it was seen to take place in greenhouses, where the heat was equal night and day, they were obliged to seek for some other cause.

9. De Candolle showed by some interesting experiments that within the empire of Flora sleep is to be attributed to the absence of light. By throwing a very bright light upon sensitive-plants during the night, and conversely, by placing them in profound darkness during the day, the learned botanist succeeded in completely changing their habits. These plants closed up their leaflets and slept the whole day, deceived by the artificial gloom, and they remained awake the whole night when six lamps projected upon them a brilliance equal to five sixths of that of daylight.

10. It is principally among plants which inhabit intertropical countries that the phenomenon in question is seen. It is particularly noticeable in the family of the *Leguminosæ*, and most of all in the sensitive-plants. Many of those in our fields show it plainly.

11. If at the close of summer we examine a clover field about six o'clock in the evening, we are struck with the aspect which all the plants present at this moment—the first of their sleep. The two side leaflets of each leaf are laid close against one another, and the middle one covers them like a protecting roof; the whole aspect of the crop has changed.

F. A. Pouchet, "The Universe."

THE BAOBAB.

1. The African baobab, or monkey-bread-tree (*Adansonia digitata*), may justly be called the elephant of the vegetable world. Near the village of Gumer, in Fassokl, Russegger saw a baobab thirty feet in diameter and ninety-five in circumference; the horizontally outstretched branches were so large that the negroes could comfortably sleep upon them. The Venetian traveler Cadamosto (1454) found, near the mouths of the Senegal, baobabs measuring more than a hundred feet in circumference. As these vegetable giants are generally hollow, like our ancient willows, they are frequently made use of as dwellings or stables, and Dr. Livingstone mentions one in which twenty or thirty men could lie down and sleep as in a hut. In the village of Grand Galarques, in Senegambia, the negroes have decorated the entrance into the cavity of a monstrous baobab with rude sculptures cut into the living wood, and make use of the interior as a kind of assembly-room, where they meet to deliberate on the interests of their small community, "reminding one," says Humboldt, "of the celebrated plantain in Lycia, in whose hollow trunk the Roman consul, Lucinius Mutianus, once dined with a party of twenty-one."

2. As the baobab begins to decay in the part where the trunk divides into the larger branches, and the process of destruction thence continues downward, the hollow space fills during the rainy season

with water, which keeps a long time, from its being protected against the rays of the sun. The baobab thus forms a vegetable cistern, whose water the neighboring villagers sell to travelers. In Kordofan the Arabs climb upon the tree, fill the water in leathern buckets, and let it down from above; but the people in Congo more ingeniously bore a hole in the trunk, which they stop, after having tapped as much as they require.

3. The height of the baobab does not correspond to its amazing bulk, as it seldom exceeds sixty feet. As it is of very rapid growth, it acquires a diameter of three or four feet and its full altitude in about thirty years, and then continues to grow in circumference. The larger beamlike branches, almost as thick at their extremity as at their origin, are abruptly rounded, and then send forth smaller branches, with large, light green, palmated leaves. The bark is smooth and grayish. The oval fruits, which are of the size of large cucumbers, and brownish-yellow when ripe, hang from long, twisted, spongy stalks, and contain a white farinaceous substance, of an agreeable acidulated taste, enveloping the dark-brown seeds. They are a favorite food of the monkeys, whence the tree has derived one of its names.

4. From the depth of the incrustations formed on the marks which the Portuguese navigators of the fifteenth century used to cut in the large baobabs which they found growing on the African coast, and by comparing the relative dimensions of several trunks of a known age, Adanson concluded that a

The Flower of the Baobab Tree

baobab of thirty feet in diameter must have lived at least five thousand years; but a more careful investigation of the rapid growth of the spongy wood has reduced the age of the giant tree to more moderate limits, and proved that even in comparative youth it attains the hoary aspect of extreme senility.

5. The baobab, which belongs to the same family as the mallow or the hollyhock, and is, like them, emollient and mucilaginous in all its parts, ranges over a wide extent of Africa, particularly in the parts where the summer rains fall in abundance, as in Senegambia, in Soudan, and in Nubia. Dr. Livingstone admired its colossal proportions on the banks of the Zouga and the Zambesi. It forms a conspicuous feature in the landscape at Manaar in Ceylon, where it has most likely been introduced by early mariners, perhaps even by the Phœnicians, as the prodigious dimensions of the trees are altogether inconsistent with the popular conjecture of a Portuguese origin.

G. Hartwig, "The Tropical World."

VALUABLE WOODS OF BRAZIL.

1. How to meet the growing demand for timber is a question of considerable interest and importance. It rises to the dignity of a national topic. While the population of the United States increases in a decade thirty-five per cent, the increase of the consumption of wood is sixty-three per cent. England imports

wood to the value of sixty million dollars, or three times as much as her home produce. The temperate zones supply most of the woods of construction, while nearly all the ornamental woods come from tropical countries. No hard timber is found in the United States west of the one hundredth meridian, and all the great forests of South America are cisandean.

2. No spot on the globe contains so much vegetable matter as the valley of the Amazons. In it we may draw a circle a thousand miles in diameter, which will include an evergreen forest, broken only by the rivers and a few grassy *campos*. The densest portion of this forest is along the base of the Andes, where the moisture and temperature are combined in the right proportion, such as existed, doubtless, in the Carboniferous age. The flowers are on the top of this mass of verdure. On many of the trees not a single blossom is to be found at a less height than one hundred feet. The glory of the forest can be seen only by sailing in a balloon over the undulating, flowery surface above. There, too, in that green cloud are the insects and birds and monkeys. You are in "the empty nave of the cathedral, and the service is being celebrated aloft in the blazing roof." In place of mosses and lichens, the trunks and boughs are bearded with epiphytic orchids, ferns, tillandsias, cactuses, etc., frequently forming hanging gardens of great beauty. In ascending the river the traveler, even if an acute botanist, is rarely able to distinguish individual trees, save the palms and certain lofty, dome-shaped crowns, for the branches are so thoroughly interwoven and so

densely veiled with twiners and epiphytes that one sees little more than a green wall. He might roam a hundred years in the Amazons' thicket, and at the end find it impossible to classify the myriad, crowded, competing shapes of vegetation. The roots even of the giants are not deep. The temperature of the interior of the forest is generally lower than that of the river bank.

3. The Amazonian sylva is naturally divided into: 1. The great or virgin forests, which clothe the *terra firma* beyond the reach of inundations and constitute the great mass of the vegetation. Here grow the fine timber-trees and the most lordly trunks, as the Brazil nut-trees. The palms are peculiar and few. 2. The low or white forests, rich and varied, growing on the *vargem*, or occasionally flooded tracts. Palms, pas-mulatto, and wild cacao are characteristic forms. 3. The riparial forests on lowlands bordering the rivers, and laid under water several months in the year. The soil is the most recent alluvium. Here thrive herbaceous plants, reeds, broad-leaved heliconias, and soft-wooded trees. Besides these are the second growth forests and the scrubby *campos*. The virgin forests are distinct "by the somber foliage of the densely packed, lofty trees, out of which stand—like the cupolas, spires, and turrets of a large city—dome-shaped or pyramidal or flat-topped crowns of still loftier trees, overtopping even the tallest palms." The riparial are marked by the varied tints of the foliage, by the greater abundance of palms and leaves, and by the humbler growth of the trees gen-

erally, which, beginning at the water's edge as low bushes, increase in height as they advance inland till they mingle with the sturdier primeval woods. The riparial forests, as we might suppose, have softer and more perishable timber and also inferior fruits.

4. Nowhere in the world is there such an amount or such a variety of useful and ornamental woods as in the virgin forests which stand around the basin of the great river. Over a hundred different kinds of highly valuable woods have been cut from a piece of land less than half a mile square. Of these, many were dark-colored, veined woods, susceptible of a high polish—as beautiful as rosewood or ebony. But the development of this industry has not even begun. There are only two sawmills on the river between Pará and the Andes—namely, at Manáos and Iquitos. When the natives want a plank, they cut down a tree and hew it with a hatchet. Several hundred kinds of choice woods, hard and heavy, finely tinted and close-grained, abound, with water-power on every tributary, and a highway by river and ocean to Europe and America, yet enough goes to rot every year to enrich an empire. It is a singular fact that dead timber is rarely to be seen in the heart of the great forest. It seems to go to dust almost immediately after its fall, the process of destruction being accelerated by insects. The like rapid decay of fallen timber was noticed by Tennent in Ceylon.

5. There are three drawbacks to lumbering on the Amazons: first, the scarcity of labor; second, the high export duty; and, third, the fact that the trees

of any one kind, though abundant, are scattered. While we have our forests of oak, pine, and hemlock, in the tropics diversity is the law. Rarely do we see half a dozen trees of the same species together.

JAMES ORTON, "The Andes and the Amazons."

GIANTS IN THE VEGETABLE WORLD.

1. THE monarch of flowers, in respect to size, is that first discovered by Sir Stamford Raffles, and named after him *Rafflesia*. It is a large, fleshy parasite, growing on the roots of other plants, without leaves, and consisting entirely of a single enormous flower, "of a very thick substance, the petals and nectary being but in a few places less than a quarter of an inch thick, and in some places three quarters of an inch. The substance of it was very succulent. When I first saw it a swarm of flies were hovering over the mouth of the nectary, and apparently laying their eggs in the substance of it. It had precisely the smell of tainted beef. It measured a full yard across; the petals, which were subrotund, being twelve inches from the base to the apex, and it being about a foot from the insertion of the one petal to the opposite one. The nectary, in the opinion of all of us, would hold twelve pints, and the weight of this prodigy we calculated to be fifteen pounds."

2. The flower was first discovered in 1818, on the Manna River, in Sumatra, where it is said to be

known by the name of the "Devil's Siri box"! Dr. Arnold says that when he first saw it in the jungle it made a powerful impression on him. "To tell the truth, had I been alone, and had there been no witnesses, I should, I think, have been fearful of mentioning the dimensions of this flower, so much does it exceed every flower I have ever seen or heard of." Another species has been found in Java, but not quite of such an enormous size.

3. Second in size are the flowers of one of the birthworts, climbing aristolochias of tropical forests. Humboldt gave the first intimation of the existence of these giants in these words: "On the shady banks of the Magdalena River, in South America, grows a climbing aristolochia, whose blossoms, measuring four feet in circumference, the Indian children sportively draw on their heads as caps." This species (*Aristolochia grandiflora*), or what is believed to be the same species, is called "pelican flower" in the West Indies, from the resemblance of its young and unopened flower to the head of a pelican at rest. Miers states that he had often seen it in Brazil, where he was led to compare the large flaccid blossoms on the bushes with colored pocket-handkerchiefs laid out to dry. Lunan remarks that the odor is so abominably fetid that it is detested and shunned by most animals; and when hogs venture, through necessity, to eat of it, it destroys them. Tussac, noting the same plant in the Antilles, says that a whole herd of swine, having been driven into the woods where this plant was common, had entirely perished

The Giant Cactus.

from eating the roots and young stems. Another species which has now flowered two or three times in this country (*Aristolochia goldieana*), comes from Old Calabar River and Sierra Leone. The flowers reach to twenty-six inches in length and eleven inches in diameter at the mouth when grown here. Like the other, it has a strong and powerful odor as of putrid meat.

4. The flowers of the night-blooming cereus (*Cereus grandiflorus*) are very different in character and inferior in size; they have, however, the merit of possessing a very grateful fragrance. It is alluded to here as one of the largest of blossoms, attaining, it is said, when fully expanded, a diameter of a foot, but as this measurement is taken from tip to tip of the petals it does not seem so large as a cup-shaped flower would be.

5. Among lilies, there are two or three magnificent species which deserve remembrance. Such, for example, is *Lilium giganteum*, of which a dried stem is preserved in one of the museums at Kew. Let the imagination strive to picture a gorgeous white lily, with a flower stem eleven and a half inches in circumference at the base and rising to a height of thirteen feet, bearing blossoms as large as tumbler glasses. It might be said literally that "Solomon in all his glory was not arrayed like one of these."

6. If one were asked to determine the largest fruit hitherto known, it is probable that the answer must be some species of gourd or "pumpkin," the dried external portion of one such specimen being

suspended in one of the museums of the Royal Gardens, Kew, with a diameter of about two feet. This far exceeds the largest "double cocoanut" (*Lodoicea sechellarum*) of which we have any experience. As far as we know, the full dimensions of the largest gourds have not been recorded, since they may attain, in their native and warmer climes, a much greater diameter than in cultivation.

7. If individual seeds are the subject of inquiry, then we are assured that the largest seeds of which we have hitherto any experience are the beans of a mora-tree (or, as it is now called, *Dimorphandra oleifera*) from Panama. These seeds are as much as six inches long, five inches broad, and four inches thick. If edible, such beans would not be requisite in any great numbers for an ordinary meal.

8. Justification might also be found for an allusion to such large starchy roots as the elephant's foot, and yams of various species, in which great bulk is combined with farinaceous qualities, which render them available, after the manner of gigantic potatoes, as articles of animal food.

9. Those truly elegant plants, the ferns, as popular as any of the members of the vegetable kingdom, have also their giants in the tree ferns of tropical climates. The "silver king" (*Cyathea dealbata*) has leaves, or fronds, from five to seven feet in length; and Dieffenbach found it growing in New Zealand with trunks upward of forty-two feet in height. Another, which might be called the "monarch" (*Dicksonia antarctica*), has fronds from six to twelve feet

in length or more. One plant, cultivated in this country, and hence probably inferior in size to those growing in its native home, is said to have produced fronds eleven feet in length and three feet two inches in width. This plant had altogether fifty fronds, which covered an area of eighteen and a half feet. In Tasmania this fern forms the great feature in the Fern Valley. Humboldt considers it singular that no mention is made of arborescent ferns in the classic authors of antiquity, the first distinct reference being by Oviedo, in the early part of the sixteenth century. However graceful and elegant some of the palms may be in their foliage and the grandeur of their crested forms, these can not be compared for beauty with the deeply cut and infinitely diversified and subdivided fronds of the larger ferns. All that the palms may claim for excess in height or bulk of trunk over the tree ferns is amply compensated in the latter by the beauty and grace of their crown of feathery fronds.

10. Sea-weeds are the most gigantic of cryptogamic plants, and of these the most noteworthy is the large Macrocystis of the antarctic seas (*Macrocystes pyrifera*). D'Urville says that it grows in eight, ten, and even fifteen fathoms of water, from which depth it ascends obliquely and floats along the surface nearly as far; this gives a length of two hundred feet. Dr. Hooker (now Sir Joseph) says: "In the Falkland Islands, Cape Horn, and Kerguelen's Land, where all the harbors are so belted with its masses that a boat can hardly be forced through, it generally rises from eight to twelve fathom water, and the fronds extend

upward of one hundred feet upon the surface. We seldom, however, had opportunities of measuring the largest specimens, though washed up entire on the shore, for on the outer coasts of the Falkland Islands, where the beach is lined for miles with entangled cables of Macrocystis much thicker than the human body, and twined of innumerable strands of stems coiled together by the rolling action of the surf, no one succeeded in unraveling from the mass any one piece upward of seventy or eighty feet long; as well might we attempt to ascertain the length of hemp fiber by unlaying a cable. In Kerguelen's Land the length of some pieces which grew in the middle of Christmas Harbor was estimated at more than three hundred feet." He afterward alludes to what he considered the largest specimen seen in what is believed to be forty-fathom water and streaming along the surface to a probable total length of about seven hundred feet. The report that this sea-weed sometimes attains a length of fifteen hundred feet is probably exaggerated, although it may be true that "it grows up from a depth of forty-five fathoms to the surface at a very oblique angle, and even when of no great breadth makes excellent natural floating breakwaters."

11. None of the remaining *Cryptogamia* attain to any extraordinary size. Neither floating mosses nor dendritic forms exceed two or three feet; and lichens only extend to about the same dimensions in the most exaggerated examples. Fungi have not yet produced a Titanic species, for the largest agaric yet known is

inferior in expanse to a lady's parasol, and a great puff-ball (*Lycoperdon giganteum*) has not yet attained the dimensions of a somnolent sheep. Among the lower *Cryptogamia* we have many examples of the infinitely little but not of the infinitely great.

M. C. Cooke, "Freaks and Marvels of Plant Life."

THE FEAST OF ROSES.

1. Who has not heard of the Vale of Cashmere,
With its roses, the brightest that earth ever gave,
Its temples and grottoes, and fountains as clear
As the love-lighted eyes that hang over their wave?

. . . . . .

2. But never yet, by night or day,
In dew of spring or summer's ray,
Did the sweet valley shine so gay
As now it shines—all love and light,
Visions by day and feasts by night!
A happier smile illumes each brow,
With quicker spread each heart uncloses
And all is ecstasy—for now
The valley holds its Feast of Roses.
That joyous time, when pleasures pour
Profusely round, and in their shower

Hearts open, like the season's rose—
The flow'ret of a hundred leaves,
Expanding while the dew-fall flows,
And every leaf its balm receives!

. . . . . .

3. A thousand restless torches played
Through every grove and island shade;
A thousand sparkling lamps were set
On every dome and minaret;
And fields and pathways, far and near,
Were lighted by a blaze so clear,
That you could see, in wandering round,
The smallest rose-leaf on the ground.

. . . . . .

4. And all exclaimed, to all they met,
That never did the summer bring
So gay a Feast of Roses yet—
The moon had never shed a light
So clear as that which blessed them there;
The roses ne'er shone half so bright,
Nor they themselves looked half so fair.
And what a wilderness of flowers!
It seemed as though from all the bowers
And fairest fields of all the year,
The mingled spoil were scattered here.
The lake, too, like a garden breathes,
With the rich buds that o'er it lie—
As if a shower of fairy wreaths
Had fallen upon it from the sky!
And then the sounds of joy—the beat
Of tabors and of dancing feet;

The merry laughter echoing
From gardens, where the silken swing
Wafts some delighted girl above
The top leaves of the orange grove;
Or, from those infant groups at play
Among the tents that line the way,
Flinging, unawed by slave or mother,
Handfuls of roses at each other!

MOORE.

THE CHOCOLATE-PLANT.

1. AT the discovery of America the natives of the narrower portion of the continent bordering on the Caribbean Sea were found in possession of two luxuries which have been everywhere recognized as worthy of extensive cultivation—namely, tobacco and chocolate. The former of these has made its way into climates totally unlike that of its early home; the other of these plants, since it can not bear the low temperature occasionally experienced in our subtropics, is more restricted in its range. The chocolate-plant is confined to the warmer regions of the globe, where it finds the congenial climatic conditions which it enjoyed and still enjoys in its earliest home in America.

2. The first references to the chocolate-plant and its products are found in the accounts of the explorers

and conquerors who followed Columbus. These first descriptions of this singular tree, of its fruits and seeds, of its uses and the methods of cultivation, are remarkably accurate in all essential particulars. By the natives of tropical America the seeds of the chocolate-plant were first roasted and then rudely ground. For this purpose they employed the flat or curved surface of the sort of stone used by them to grind their maize or Indian corn. The roller was merely a short, thick stone of a cylindrical shape, which could be used with one or both hands, somewhat after the manner of the common rolling-pin everywhere used in kitchens. By this simple appliance the crushed seeds were mixed with various ingredients, among which may be mentioned spices of different kinds. A modification of this was later used in Spain. The drinks made from this coarse chocolate were frequently very complex, but the chocolate itself was the chief constituent. It was the custom to beat the mixture into a froth or foam by means of stirrers of mallet-like forms; in fact, it is said by some writers that the very name *chocolate* is derived from a native word indicating the noise made by the stirring of the beverage.

3. After its introduction into Europe from America, chocolate was used at first only as a luxury, but it has steadily advanced in popular esteem until it is now recognized as one of the necessaries of life.

4. It would be interesting to speculate as to the accidents which led to the original use of such beverages as coffee, tea, and chocolate. The earliest em-

ployment of the two former is veiled in as deep a mystery as that which surrounds the chocolate-plant. All were used at the outset by what we have been accustomed to call the uncultivated races of mankind, but we can not surmise what first attracted their attention to these plants. One can only say that by the natives of lands where the plants grow naturally they have all been used from time immemorial, and that all three are welcome gifts from a rude state of civilization to the highest which exists to-day. By the savages and the Aztecs of America, by the roving tribes of Arabia, and by the dwellers in the farther East, the virtues of those three plants were recognized long before any one of them was introduced into Europe.

5. There is reason to believe that long before the discovery of America tea and coffee had been vaguely known to travelers in the Orient as curiosities, much as we do to-day regard the kola-nut and maté, but neither tea nor coffee was then employed as a beverage anywhere in western Europe. In fact, all trustworthy evidence in the case leads us to a surprising conclusion—namely, that chocolate was the first of these beverages to attract the attention of Europeans. This beverage rapidly made its way throughout Europe, beginning from Spain and Portugal, whither its discoverers had brought it. The other beverages, tea and coffee, soon followed, and after a short time became associated together in popular regard.

6. The chocolate-plant is known to botanists as

Theobroma cacao. The first or generic word in this name means "food of the gods." The genus contains six species, only one of which is generally cultivated. It is probable, however, that some of the seeds which find their way into commerce are yielded by other and wild species. It is, moreover, more than likely that among the numerous varieties of *Theobroma cacao* now cultivated there may be some hybrids between the different forms. The plant belongs to the *Sterculiaceæ*, a natural order containing forty-one genera and five hundred and twenty species.

7. The pod is irregular and angular, much like some forms of cucumbers, but more pointed at the lower extremity and more distinctly grooved. It measures in length nine inches to a foot or even more, and about half as much in diameter. The color, when young, is green, becoming later dark yellow or yellowish brown. The rind is thick and tough. The pod is filled with closely packed "beans," or seeds, imbedded in a mass of cellular tissue, sometimes of pleasant subacid taste. The seeds are about as large as ordinary almonds, whitish when fresh, and of a disagreeable, bitter taste. When dried they become brown. The fruits are about four months in ripening, but they appear and mature the whole year through. In point of fact, however, there are chief harvests, usually in early spring, but this is different for different countries.

8. The seeds of the chocolate-plant are brought into the market in their crude state, as almond-shaped "beans," which differ in color and somewhat in tex-

ture. Upon the color of shell and kernel, the relative brittleness, the flavor, and the odor, depend the market value of seeds. The dried seeds have a papery, brittle shell, which is very smooth on the inside, but on the outside exhibits, under the microscope, a few short hairs and round excrescences. But these are mostly lost by the rough handling and by the attrition of the seeds with one another during transportation. The kernel consists of two large cotyledons or seed-leaves, reddish gray or reddish brown, with a shining, oily surface, the whole crushing rather easily into a loose mass of fragments. The kernel, when dry, has a minute, tough, almost stony radicle which separates easily from the cotyledons. Microscopic examination shows that the cells of the seed-leaves contain albumin, oily matters—sometimes in a crystalline condition—crystals of an entirely different shape, starch, coloring substances in special receptacles known as pigment cells, and ducts with spiral markings. The starch grains do not have any very characteristic form or markings; they are generally spherical and simple. The only peculiarity worth mentioning is the relative slowness with which they are acted on by hot water and by iodine. The coloring substances are mainly of a carmine or violet color, and are distinguished by the change of shade when an alkali is added, becoming thereby darker. These are the only structural elements which a pure powder or paste of chocolate should show under the microscope. Any other substances must be recognized as accidental or intentional additions.

9. All seeds of whatever kind contain, as a part of their substance, the matter of which cell-walls are made—namely, cellulose. The percentage differs in different seeds, in those of the chocolate-plant being about three in the hundred. Cellulose has the same chemical composition as starch, but its physical properties are not the same as those of starch, among which may be mentioned its entire insolubility in boiling water. Starch forms, on an average, eight to ten per cent of chocolate-seeds. It consists of minute spherical grains, not distinguishable from that found in many other kinds of seeds. Traces of gum and other allied bodies are also present in the seeds.

10. Albuminoids, or substances resembling in a general way the albumin of egg, occur in chocolate-seeds as they do in other seeds, and in a somewhat higher amount than in certain other cases in which the seeds are used as food. The percentage ranges from about fifteen to twenty, depending on the variety. These albuminoids are compounds of nitrogen and are extremely nutritious. In the seeds they occur in a readily assimilable form, fit for digestion.

ANONYMOUS, "The School Journal."

THE CINNAMON GARDENS OF CEYLON.

1. Although the beautiful laurel whose bark furnishes the most exquisite of all the spices of the East is indigenous to the forests of Ceylon, yet, as no author previous to the fourteenth century mentions its aromatic rind among the productions of the island, there is every reason to believe that the cinnamon, which in the earlier ages was imported into Europe through Arabia, was obtained first from Africa and afterward from India. That the Portuguese, who had been mainly attracted to the East by the fame of its spices, were nearly twenty years in India before they took steps to obtain a footing at Colombo, proves that there can have been nothing very remarkable in the quality of the spice at the beginning of the sixteenth century, and that the high reputation of the Ceylon cinnamon is comparatively modern and attributable to the attention bestowed upon its preparation for market by the Portuguese and afterward on its cultivation by the Dutch.

2. Long after the appearance of Europeans in Ceylon, cinnamon was only found in the forests of the interior, where it was cut and brought away by the Chalias, an emigrant tribe which, in consideration of its location in villages, was bound to go into the woods to cut and deliver, at certain prices, a given quantity of cinnamon properly peeled and ready for exportation. This system remained unchanged so long as Portugal was master of the country, but the

forests in which the spice was found being exposed to constant incursions from the Kandyans, the Dutch were compelled to form inclosed plantations of their own within range of their fortresses. The native chieftains, fearful of losing the profits derived from the labors of the Chalias, who were attached as serfs to their domains and whose work they let out to the Dutch, were at first extremely opposed to this innovation, and endeavored to persuade the Hollanders that the cinnamon would degenerate as soon as it was artificially planted. The withering of many of the young trees seemed to justify the assertion, but on a closer examination it was found that boiling water had been poured upon the roots. A law was now passed declaring the willful injury of a cinnamon plant punishable with death, and by this severity the product was saved.

3. The extent of the trade during the time of the Dutch may be inferred from the fact that the five principal cinnamon gardens around Nejombo, Colombo, Barberyn, Galle, and Maduro were each from fifteen to twenty miles in circumference. Although they were only first planted in the year 1770, yet before 1796, when Colombo was taken by the English, their annual produce amounted to more than four hundred thousand pounds of cinnamon, as much as the demands of the market required.

4. The profits must have been enormous, for cinnamon was then at least ten times dearer than at present, the trade being exclusively in the hands of the Dutch East Indian Company, which, in order to

keep up the price, restricted the production to a certain quantity, and watched over its monopoly with the most jealous tyranny. No one was allowed to plant cinnamon or to peel it, and the selling or importing of a single stick was punished as a capital offence. Since that time the cultivation of the cinnamon laurel having been introduced into many other tropical lands, competition has reduced prices, and the spice which was formerly the main product of Ceylon is now of very inferior importance. The cinnamon gardens, whose beauty and luxuriance have been so often vaunted by travelers, have partly been sold, partly leased to private individuals, and, though less than a century has elapsed since they were formed by the Dutch, they are already becoming a wilderness. Those which surround Colombo on the land side exhibit the effects of a quarter of a century of neglect, and produce a feeling of disappointment and melancholy. The beautiful shrubs which furnish this spice have been left to the wild growth of Nature, and in some places are entirely supplanted by an undergrowth of jungle, while in others a thick cover of climbing plants and other parasites conceals them under masses of verdure and blossom.

5. It would, however, be erroneous to suppose that the cinnamon gardens have been universally doomed to the same neglect. Thus Prof. Schmarda, who visited Mr. Stewart's plantation two miles to the south of Colombo, admired the beautiful order in which it was kept. A reddish sandy clay and fine white quartz sand form the soil of the plantation.

White sand is considered as the best ground for the cinnamon-tree to grow on, but it requires an abundance of rain (which is never wanting in the south-western part of the island), much sun, and many termites. For these otherwise so destructive creatures do not injure the cinnamon-trees, but render themselves useful by destroying many other insects. They consequently remain unmolested, and everywhere raise their high conical mounds in the midst of the plantation. The aspect of a well-conditioned cinnamon garden is rather monotonous, for, though the trees when left to their full growth attain a height of forty or fifty feet, yet, as the best spice is furnished by the shoots that spring from the roots after the chief stem has been removed, they are kept as a kind of coppice and not allowed to rise higher than ten feet.

G. Hartwig, "The Tropical World."

CURIOSITIES IN THE VEGETABLE KINGDOM.

1. The difference between animals and vegetables is so great that at first we do not perceive any resemblance between them. Some animals only live in water, others on the earth or in the air, and some are amphibious, or live equally well in water as upon land. And this is literally the case with vegetables: some of them only grow upon land, others in the wa-

ter; some can scarcely bear any moisture, others live either in earth or water, and some even are found that exist in the air.

2. There is a tree in an island of Japan which, contrary to the nature of all others to which moisture is necessary, can not bear the least portion. As soon as it is watered it perishes; the only way to preserve it in such a case is to cut it off by the root, which is to be dried in the sun and afterward planted in a dry and sandy soil. A peculiar species of mushroom, some mosses, and other small plants, float in the air; but what is more extraordinary, a branch of rosemary which, as is the custom of some countries, was put in the hand of a corpse, sprouted out to the right and left so vigorously that, after a lapse of some years, the grave being opened, the face of the defunct was overshadowed with rosemary-leaves. The vegetation of the truffle is still more singular. This extraordinary tubercle has neither roots, stem, leaves, flowers, nor seeds; it derives its nourishment through the pores of its bark. But, it may be asked, How is it produced? why is there commonly no kind of herb in the places where this species of fungus grows? and why is the land there dry and full of crevices? These things have never been explained.

3. No plant so much resembles animals as that species of membranous moss called nostoc; it is an irregular substance of a pale-green color and somewhat transparent; it trembles upon the slightest touch and easily breaks. It can only be seen after rain, and is then found in many places, particularly in uncultivated

vated soils and sandy roads. It exists in all seasons, even in winter; but is never so abundant as after rain in summer. The most remarkable circumstance about it is its speedy growth, being formed almost instantaneously. Sometimes walking in the garden in summer not a trace of it is seen, when, a sudden shower of rain falling, if the same place is visited in an hour the walks are entirely covered with it. The nostoc was long supposed to have descended from the sky, but it is now known to be a leaf which attracts and imbibes water with great avidity. This leaf, to which no root appears to belong, is in its natural state when impregnated with water; but, a strong wind or great heat soon dissipating the water, the leaf contracts and loses its color and transparency; hence it appears to grow so suddenly and to be so miraculously produced by a shower of rain, for when the rain falls upon it in its dried and imperceptible state it becomes reanimated and appears a fresh production.

4. We might readily enumerate a variety of plants that bear a resemblance to animals, but there are other peculiarities in vegetables which solicit our attention. The whole atmosphere is pregnant with plants and invisible seeds, and even the largest grains are dispersed by the wind over the earth, and as soon as they are transported to the places where they may germinate they become plants, and often so little soil is necessary for this purpose that we can scarcely conceive whence they derive the necessary degree of nourishment. There are plants, and even trees, which take root and grow in the clefts of rocks without any

soil. Vegetation is sometimes very rapid, of which we have instances in mushrooms and the common cresses, the seed of which, if put into a wet cloth, will be fit for a salad in twenty-four hours.

5. There are plants that exist with scarcely any perceptible vitality. We often see willows which are not only hollowed and decayed within, but their external bark is so much injured that very little of it remains, yet from these seemingly sapless trunks buds sprout in the spring and they are crowned with leaves and branches. How admirable that plants should not only imbibe nutriment by their roots, but that their leaves also should assist in this important function by inspiring air! And an inverted tree will flourish as well as when in its proper position, for the branches will grow in the earth and become roots! The advanced age that some trees attain is also very wonderful. Some apple-trees are above a thousand years old, and if we calculate the amount of the annual produce of such a tree for the above space of time, we shall find that a single pippin might supply all Europe with trees and fruit.

I. Platt, "The World's Encyclopædia of Wonders and Curiosities."

THE PUMPKIN.

1. Oh, greenly and fair in the lands of the sun,
The vines of the gourd and the rich melon run,
And the rock and the tree and the cottage infold,
With broad leaves all greenness and blossoms all gold,
Like that which o'er Nineveh's prophet once grew,
While he waited to know that his warning was true,
And longed for the storm-cloud, and listened in vain
For the rush of the whirlwind and red fire rain.

2. On the banks of the Xenil, the dark Spanish maiden
Comes up with the fruit of the tangled vine laden;
And the creole of Cuba laughs out to behold
Through orange-leaves shining the broad spheres of gold;
Yet with dearer delight from his home in the North,
On the fields of his harvest the Yankee looks forth,
Where crooknecks are coiling and yellow fruit shines,
And the sun of September melts down on his vines.

3. Ah! on Thanksgiving Day, when from East and from West,
From North and from South, come the pilgrim and guest,
When the gray-haired New-Englander sees round his board
The old broken links of affection restored,

When the care-wearied man seeks his mother once more,
And the worn matron smiles where the girl smiled before,
What moistens the lip and what brightens the eye?
What calls back the past, like the rich pumpkin-pie?

4. O fruit loved of boyhood! the old days recalling;
When wood-grapes were purpling and brown nuts were falling!
When wild, ugly faces we carved in its skin,
Glaring out through the dark with a candle within!
When we laughed round the corn-heap, with hearts all in tune,
Our chair a broad pumpkin, our lantern the moon,
Telling tales of the fairy who traveled like steam
In a pumpkin-shell coach, with two rats for her team!

5. Then thanks for thy present! none sweeter or better
E'er smoked from an oven or circled a platter!
Fairer hands never wrought at a pastry more fine,
Brighter eyes never watched o'er its baking, than thine!
And the prayer, which my mouth is too full to express,
Swells my heart that thy shadow may never be less;
That the days of thy lot may be lengthened below,
And the fame of thy worth like a pumpkin-vine grow;
And thy life be as sweet, and its last sunset sky
Golden-tinted and fair as thy own pumpkin-pie!

WHITTIER.

CARNIVOROUS PLANTS.

1. In the whole range of vegetable creation it will be difficult to find anything more curious than the carnivorous or flesh-eating plants. We think without any emotion of curiosity of animals eating plants, for this is the common law of Nature. But here we have the reverse marvel of plants devouring animals. It is not many years ago that the attention of naturalists was first specially called to the habits and character of these strange forms of vegetable life, though they have been known for about a century. It is Mr. Darwin, the celebrated philosopher, who has made so many wonderful discoveries in natural science —discoveries which have excited more discussion than those of any scientific man of his age, perhaps of all ages—who has done more than any other observer to explain the life and operations of the flesh-eating plants.

2. For several centuries there had been strange rumors of huge plants in the more remote and unvisited parts of the Oriental countries which would imprison and destroy even large animals and men who ventured within reach of their great, quivering leaves, armed with hooked thorns, and would absorb the flesh of the dead victims into their structure. Asia has always been the land of mystery and marvel, but, like many another story of that far-off land, the giant flesh-eating tree or plant has so far proved to be a mere myth. Science has discovered, however, that

there is a foundation for this exciting fiction, and it has not needed to go to the distant lands of the East to find it, for flesh-eating plants are by no means uncommon in this country and Europe. These plants, however, confine their destructive properties to the flying and crawling insects which are beguiled to rest on their leaves. Such a strange provision of Nature is no less interesting than if the carnivorous plants had the power to destroy the larger animals, for it is the fact itself which startles the attention, from its seeming reversal of ordinary laws.

3. To use the words of Mr. Darwin, there can be no doubt that a plant of this description "digests exactly the same substances in exactly the same way that the human stomach does." Let us take as our first example the plant known as the *Dionæa muscipula*, or, to use the common name, Venus's-flytrap. About the year 1768 Mr. Ellis, an English naturalist, sent to the great Swedish botanist, Linnæus, the following description of this plant: "The plant shows that Nature may have some views toward its nourishment in forming the upper joint of its leaf like a machine to catch food. Upon the middle of this lies the bait for the unhappy insect that becomes its prey. Many minute red glands, which cover its surface and which perhaps discharge sweet liquor, tempt the animal to taste them, and the instant those tender parts are irritated by its feet the two lobes rise up, grasp it fast, lock the rows of spines together, and squeeze it to death. And further, lest the strong effort for life in the creature just taken should serve to disen-

gage it, these small erect spines are fixed near the middle of each lobe among the glands that effectually put an end to its struggles. Nor do the lobes ever open again while the dead animal continues there. But it is, nevertheless, certain that the plant can not distinguish an animal from a vegetable or mineral substance, for if we introduce a straw or pin between the lobes it will grasp it fully as fast as if it were an insect."

4. This description, though written long before any very careful study of this class of plants has been made, is in the main correct, in spite of the failure to understand clearly that there was a well-defined provision of Nature for supplying the plant with food. Each half of the leaf of a Venus's-flytrap is a little concave on the inner side, where are placed these delicate hairlike organs, in such an order that an insect can hardly traverse it without interfering with one of them, when the two sides suddenly collapse and inclose the prey with a force defying all attempts at escape. The insect, however, does not appear to be crushed by the pressure, but is retained in the leafy cell until it becomes enveloped in a sort of sticky fluid, which appears to be a solvent, like gastric juice, the fly being consumed in it and then absorbed into the tissues of the plant.

5. One group of plants which live on animal food is known under the name of *Drosera*, or sundew. This plant may be described as consisting of a tuft of diminutive orb-shaped leaves, from the center of which there shoots up in midsummer a slender stem

of inconspicuous flowers. As in the case of the Venus's-flytrap, the leaves of this plant are its distinguishing feature. These are covered with shining scarlet hairs which secrete at their tips drops of a clear viscid fluid resembling dew, which increase in size and number with the heat of the sun, while real dew would be quickly dried up under the same conditions. It is from this fact that the popular name of sundew is derived. But the design of this novel secretion is more strange than the fact of its production. Instantly that insects attracted by the fatal sweetness touch and taste, they are lost. The adhesive quality of the liquid holds them fast, while the delicate hairs, moving slowly but surely on the victim, fix their little points like fangs and suck its juices, leaving only a dry carcass. This accomplished, they leisurely relax their hold, return to their natural position, and wait for fresh victims. Unlike the Venus's-flytrap, the sundew takes no notice of the touch of anything unsuitable for its food. The sensitive fibers refuse to respond if they are touched by a straw or bit of paper, and it is only when their natural prey is felt that they show signs of life. The sundews are natives of the temperate parts of both hemispheres, and are found in dry and marshy places.

6. Another plant of kindred character is that known as the *Cephalotus*, which is a native of Australia. It is an almost stemless herb, the upper part of which is divided into two or three short stems that bear clusters of purplish leaves. Among these leaves, principally occupying the surface, are several beautiful

and curious pitcher-shaped appendages, attached by stout stems. The form of the insect trap is slipper-shaped, the color green, tinged with purple, and it is furnished with two lateral oblique wings and a central one dilated at the margin. These wings are fringed with hairs, and over the top is a cup-shaped formation, which acts as a lid to the trap beneath. This trap is, as it were, baited with a sweet watery fluid, which attracts the insects, especially ants. The inner walls are clouded with dark purple. The main stalk rises about two feet above the cluster of leaves, and is crowned in June and July with a cluster of small white flowers.

7. Turning from these so-called sensitive-plants, in which there appears to be an intelligent movement, something more than a merely automatic and involuntary action of the leaves, let us consider the second group of carnivorous plants, which may be grouped as pitcher-plants. The *Sarracenia variolaris* is a marked type, and is found in the Eastern and Southern States of North America, widely distributed. The whole inner surface of this tube-shaped flower is covered with fine bristles, projecting inward and inclining downward. This natural abattis extends to within a short distance of the bottom. Below this line of bristles the tube contains an astringent, sticky fluid, which acts the part of both a narcotic and digester of the ill-fated creature that lights on its treacherous surface. That there may be no lack of food, Nature has provided this hypocritical plant with a cup of sweets which is distributed in the form of drops of

crystal honey. This secretion, which extends along the outer ridge of the plant to the ground, is sweet but not intoxicating, and it is up this alluring but fatal pathway that ants, bugs, and other creeping insects pass. Having once passed over the upper edge, the fly, ant, or beetle becomes entangled in the mesh of bristles within. Each struggle makes the end more certain, as the prey is continually forced downward till it falls into the fluid below, and then it passes rapidly through the stages of intoxication and death. So effectual is the breastwork of bristles that the insect rarely escapes which crawls over the rim of that voracious cup. The tube is often found filled to the depth of several inches with a mass of decaying hornets, beetles, ants, flies, and worms.

8. Yet while insects of nearly every description are found in this fatal pitcher, there are two which successfully brave its dangers and make their home in its leaves. One of these is a small moth, the larva of which makes a web just within the mouth of the tube and feeds on its substance. The other is a flesh-fly, which drops her living larvæ into the tube to the number of a dozen or more. These feed on the soft parts of the dead insects and on each other, so that only one finally matures to burrow its way through the base of the tube into the ground and become a full-fledged fly. In this way the destructive plant furnishes a nest and food for one of the creatures on whose race it makes such continual war.

9. Closely allied to this Eastern genus of the pitcher-plant is the *Darlingtonia*, which is found on

the western slopes of the Sierra Nevada. This plant has pitchers of two forms, one peculiar to the infant state and constructed in the form of a twisted leaf, and the other a large pitcher with an inflated head which acts as a roof over the tube below. The flabby two-leafed organ which hangs from the outer edge of the head is orange-red in color, and smeared with a sweet liquid on its inner surface. In the interior structure of this plant there is a close resemblance to the preceding one. We find the same network of bristles, the same vat of intoxicating liquid below. The head over the plant is perfectly waterproof, and not a drop of rain or dew can ever get in to dilute the strength of the death-doing secretion. In addition to the attraction of the honey-sweet fluid, the colors of this plant seem to be chosen with a view to charm the eye of the insect, and thus allure it to death by the power of beauty.

10. The third, and in many respects most formidable, type of carnivorous plants of this family is the *Nepenthes*, which numbers upward of thirty different species. They are wood-climbers, and the action of the tendrils is a feature of equal interest with the functions of the pitcher-shaped flower. In the young plant the lid of the pitcher is tightly closed, but with age it rises on the hinge and opens the cup to the entrance of rain and dew. It is stated that these pitchers have been found on the mountains of Borneo measuring a foot and a half in length, and with a bowl large enough to drown a small animal or a good-sized bird. Regarding the interior formation of these

bowls, we are told that from the mouth to a variable distance down the pitcher is an opaque, smooth surface, formed with a fine network of cells, covered with a glass-like cuticle, which gives the insect no possible foothold. Though exposed to the entrance of the rain, the fluid in the cup is always acid, almost caustic, and doubtless it is the digestive fluid of the plant.

11. That animal food is essential to the growth and development of all these plants is beyond all question. On close examination of a cross-section of the pitcher of one of these vegetable ghouls there are found near the bottom tubular cells leading down through the stem into the main stalk. Through these pipes or canals the liquid manure, so to speak, resulting from the decomposition of insects, is conveyed to the various parts of the plant. The similarity between this process and natural digestion will at once impress itself on the mind. Many other plants besides those which have been described are flesh-eaters, and it is probable that science, as it extends its observations, will greatly increase the list. There are many parts of the world, especially in the vast forests of the tropics, whose deep and gloomy shades have never been penetrated by the eye of man, and it would be by no means surprising if the adventurous naturalist should yet discover some monstrous growth which would surpass, in the extent of its appetite and its power of gratifying it, any plant yet discovered—some ravenous shark or tiger of the vegetable creation.

ANONYMOUS, "A World of Wonders."

THE COTTON-PLANT.

1. Under the Plantagenets and the Tudors wool formed the chief export of England. The pastoral races that inhabited the British Isles, unskilled in weaving, suffered the more industrious Flemings to convert their fleeces into tissues; and the dominions of the Duke of Burgundy, enriched by manufactures and by the stimulus they gave to agriculture, became the most prosperous part of Europe. At length the islanders began to discover the sources of the wealth which rendered Ghent and Bruges, Ypres and Louvain, the marvel and envy of the mediæval world; and, gradually learning to keep their wool at home, invited the Flemings to the shores of England.

2. The bigoted oppression of Spain came in aid of this more enlightened policy. Our wool ceased to be sent abroad, and English cloth eventually became the chief of our exports. But, like all human affairs, trade is subject to eternal fluctuation, new wants are constantly created, new markets opened, new articles introduced, and thus, almost within the memory of living man, the wool-manufactory has ceased to be the great staple of our industry; and, thanks to the inventive genius of our Arkwrights and Cromptons, a vegetable fiber furnished by a plant totally unknown to our forefathers now ranks as the first of all the world-wide importations of England.

3. There are many different species of the cotton-plant—herbaceous, shrubby, and arboreal. Their

original birthplace is the tropical zone, where they are found growing wild in all parts of the world; but the herbaceous species still thrive under a mean temperature of from 60° to 64° F., and are capable of being cultivated with advantage as far as 40° or even 46° north latitude. The five-lobed leaves have a dark-green color, the flowers are yellow with a purple center, and produce a pod about the size of a walnut, which, when ripe, bursts and exhibits to view the fleecy cotton in which the seeds are securely imbedded.

4. It is almost superfluous to mention that the United States is the first cotton-producing country in the world. The area suitable for cotton south of the thirty-sixth degree of latitude comprises more than thirty-nine million acres, of which less than one sixth part is now devoted to the plant. The yield depends in part upon the length of season. Seven months are required for an average crop, and the average periods in which the last killing frost of spring and the first killing frost of autumn occur are March 23d and October 26th. Cotton is cultivated in large fields, and, when the soil is superior, the plant rises to a height of six or eight feet, although in the richest canebrake soil, exhausted by successive crops, it dwindles down to a height of three or four feet only. The aspect of a cotton field is most pleasing in the autumn, when the dark-colored foliage and bright yellow flowers, intermingling with the snow-white down of the pods when burst, produce a charming contrast. At that time all hands are at work, for it is important to pluck as much as possible during the first hours of morning,

since the heat of the sun injures the color of the cotton, and the over-ripe capsules shed their contents upon the ground or allow the wind to carry them away.

5. The collected produce is immediately carried to the steam-mill to be cleansed of the seeds and then closely packed in bales, which in the seaports are further reduced by hydraulic presses to half their previous volume, thus causing a great saving in the freight. Large clippers frequently carry eight or ten thousand of these bales to Liverpool, whence, perhaps on the day of their arrival, they are conveyed by rail to the next manufacturing town, which returns them in a few days to the port, ready to clothe the Australian gold-digger or the laborer on the banks of the Ganges.

6. India, which still in the last century provided Europe with the finest cambrics and muslins, now yearly receives from England cotton goods to a large amount. Thus the stream of trade may be said to have rolled backward to its source, for though the wants of the Hindoo are easily satisfied and cotton grows at his very door, yet his hand-loom is unable to compete with the machinery and the capital of England. Even in the exportation of the raw material he labors under great disadvantage when compared with America, though railroads and a better system of culture have done much to improve the quality and facilitate the transport of Indian cotton.

G. HARTWIG, "The Tropical World."

THE ROSE AMONG THE ANCIENTS.

1. The rose was the theme of the earliest poets of antiquity, and it was doubtless one of the first plants selected to adorn the gardens which were laid out around the new habitations constructed upon the exchange of the wandering for a civilized mode of life. The most ancient authors upon husbandry whose works are extant have all treated of the culture of roses: Theophrastus among the Greeks, and among the Romans Varro, Columella, Palladius, and Pliny. To Pliny are we specially indebted for information on this subject, as the entire fourth chapter of the twentieth book of his "Natural History" is devoted to roses, and they are also occasionally mentioned in other parts of the work. But after all the information thus obtained much yet remains to be desired, and, although we find in other ancient authors some curious facts bearing upon other points in the history of the rose, they are mostly so general in their character as to give us very little insight into the actual culture of the rose at those periods.

2. The profuseness with which they were used among the Greeks, the Romans, the Egyptians, and other ancient nations in their religious solemnities, their public ceremonies, and even in the ordinary customs of private life, would lead us to suppose, and with some degree of correctness, that roses were very abundantly cultivated by them all, and we are inclined to think that their cultivation was then far more

general than at the present time, although the art of producing them was in its infancy. However surprising in other respects may have been the progress of the culture of roses within forty years, particularly in France, Holland, and Belgium, there can be little doubt that, although the Romans were acquainted with a much smaller number of varieties than the moderns, yet flowers of those varieties were far more abundant than the aggregate quantity of flowers of all the varieties of roses cultivated at the present day. It can not be positively asserted that the hybrid perpetual roses of the present day were unknown at Rome, since the gardeners of that city practiced sowing the seeds of the rose, by which mode many of the most remarkable varieties of that class have been obtained by modern cultivators. The Romans, however, preferred to propagate by cuttings, which produced flowers much sooner than the seed-bed.

3. But, though the Romans may have had roses of the same species with some of those which we now cultivate, it is scarcely probable that these species could have continued until this period and escaped the devastation attendant on the revolutions of empire, or the more desolating invasions of the Huns and Goths. Thus it is that those roses of Pæstum to which allusion is so frequently made by ancient writers, and which, according to Virgil and Pliny, bloomed semi-annually and were common in the gardens of that city, are not now to be found. Jussieu and Laudresse, two French botanists, successively visited Italy with the express object of finding this twice-

bearing rose in Pæstum or its environs, yet, notwithstanding their carefully prosecuted researches, they could find no traces of it whatever. Although the number of varieties known to the Romans was very limited, they had discovered a method of making the blooming season continue many months. According to Pliny, the roses of Carthage, in Africa, came forward early and bloomed in winter, those of Campania bloomed next in order, then those of Malta, and, lastly, those of Pæstum, which flowered in the spring and autumn. It was probably the blooming of this last species which the gardeners of Rome discovered (in Seneca's time) the secret of retarding by a certain process, or of hastening by means of their warm greenhouses.

4. The Romans derived the use of this flower from the Greeks. In Greece and throughout the East roses were cultivated, not only for the various purposes we have mentioned, but also for the extraction of their perfumes. Among the many plans which they adopted for preserving the flower was that of cutting off the top of a reed, splitting it down a short distance, and inclosing in it a number of rose-buds, which, being bound around with papyrus, prevented their fragrance from escaping. The Greeks also deemed it a great addition to the fragrance of the rose to plant garlic near its roots. The island of Rhodes, which has successively borne many names, was particularly indebted to the culture of roses for that which it bears at this day. It was the Isle of Roses, the Greek for rose being *Rodon*. Medals of Rhodes,

whose reverse impressions present a rose in bloom on one side and the sunflower on the other, are to be found even now in cabinets of curiosities.

5. Extravagance in roses among the Romans kept pace with the increase of their power, until they at length desired them at all seasons. At first they procured their winter's supply from Egypt, but subsequently attained themselves such skill in their culture as to produce them in abundance, even at the coldest season of the year, and, according to Seneca, by means of greenhouses heated by pipes filled with hot water. During the reign of Domitian the forcing of roses was carried to such perfection, and flowers produced in winter in so great abundance, that those brought from Egypt, as before mentioned, excited only the contempt of the citizens of the world's metropolis. This fact, as also handed down to us by the epigram of Martial, is of great assistance in estimating the importance of rose-culture at that period, and in showing how the art of cultivating this plant had spread, and how it was already far advanced among the ancient Romans and their contemporaries.

6. If the Egyptians cultivated roses for transportation to Rome during the winter, they must have had very extensive plantations for the purpose. The exportation could not have been of loose flowers, for they would have been withered long before the termination of the voyage; neither could it have been of rooted plants in a dormant state, as nurserymen now send them to every part of the world, because the Romans had at that time no means of causing

them to vegetate and bloom in the winter. On the contrary, the cultivators at Alexandria and Memphis must, of necessity, have sent them away in the vases and boxes in which they had planted them with that object, and when they were just beginning to break from the bud, in order that they might arrive at Rome at the moment they commenced expanding. At that remote period, when navigation was far behind its present state of perfection, the voyage from the mouth of the Nile to the coast of Italy occupied more than twenty days. When this long voyage is considered, and also the quantity of roses required by the Romans to enwreath their crowns and garlands, to cover their tables and couches and the pavements of their festive halls, and to surround the urns which contained the ashes of their dead, it is evident that the Egyptians, who traded in roses, in order to satisfy the prodigality of the Romans, would be compelled to keep in readiness a certain number of vessels to be laden with boxes or vases of rose-plants, so prepared as not to bloom before their delivery at Rome. The cost of roses thus delivered in Rome must have been immense, but we do not find a single passage in ancient authors which can give any light on this point; they only tell us that nothing for the gratification of luxury was considered too costly by the wealthy Roman citizens.

7. Nor do they afford more positive information as to the species of rose cultivated on the borders of the Nile, to gratify this taste of the Romans. According to Delile, there were found in Egypt at the

time of the French expedition into that country only the white rose and the *Centifolia* or hundred-leaved —two species not very susceptible of either a forcing or retarding culture. The only rose known at that time which bloomed in the winter was the rose of Pæstum, referred to by Virgil as "biferique rosaria Pæsti," and which was probably the same as our monthly damask rose, and which produced in Egypt and Rome flowers at all seasons, as the damask does now with us, under a proper mode of culture.

SAMUEL B. PARSONS, "The Rose."

A CHAPTER ON FLOWERS.

"With what a glory comes and goes the year!
The buds of spring, those beautiful harbingers
Of sunny skies and cloudless times, enjoy
Life's newness, and earth's garniture spread out;
And when the silver habit of the clouds
Comes down upon the autumn sun, and with
A sober gladness the old year takes up
His bright inheritance of golden fruits,
A pomp and pageant fill the splendid scene."

LONGFELLOW.

1. FLOWERS! Wild flowers! how full of association is the very name! How fraught with reminiscences of the breezy hill; how redolent of woodland odors; how musical with the dash of the waterfall,

the rushing of the mountain stream, the rustling of the sedgy rivulet! The blossoms which reward our patient care within the garden's bounds are beautiful beyond compare; they have grown up beneath our guardianship, and they recompense us as only Nature can recompense the heart that values her gifts. They are beautiful, and we watch their development, we dwell upon their loveliness, we drink their perfumed breath with a sense of pleasure and of pride. But the wild flowers—the gems which God's own hand has scattered abroad in the wilderness—blossoms sown by the wind, nursed by the shower, peering from their covert on the hillside, smiling upon us from the cleft of some dark ravine, looking down tenderly from the face of some rugged cliff—these bring to our souls those surprises of sudden joy which keep the heart forever awake to a blessedness like that of innocent childhood.

"Nature ne'er betrays
The heart that loves her. Other joys may fail,
And other hopes may wither; blight may fall
On Love's fair blossom, and dark mildew steal
O'er wealth's rich gifts; the laurel crown may drop
Its shining leaves, and all that men most prize
May cheat their souls with promises untrue;
But Nature's gifts are boundless, she doth show
Ever a loving face to those who come
In lowliness of spirit to her shrine."

2. Of all remedies for a world-wearied spirit, commend me to a day in the woods. The feeling of freedom, the unconsciousness of having left turmoil

and disquiet behind, becomes the first element of repose to the heart. Then come the thousand new delights—new, even if enjoyed a myriad of times before—which Nature offers to our acceptance. The soul and the sense alike are gratified. Beneath our feet is spread a carpet of moss and fallen leaves, whose elastic fabric gives buoyancy to our step. We inhale the spicy fragrance of the woodland air; we gaze upward and behold the towering majesty of the forest king; we look beside us, and the meek beauty of the wild flower greets the eye; while the ear, pained so long by the confused murmur of a crowd, is now soothed by a stillness unbroken save by Nature's voices.

3. Let us forth and wander, in memory or in fancy, through such a scene, in the soft balmy days of early summer, or beneath the lingering influences of departing spring. The sun beats with too fierce a heat on the upland walk; but lo! a green and sheltered vale invites our steps, and leads to the cool forest shade. We seek no path, for we would fain wind as we list through the leafy labyrinth, and look on Nature in her most secluded bowers. The interlacing branches have shut out every ray of sunshine, and the shadows lie in heavy blackness upon the thick turf. A pleasant shiver runs through the heated frame, and we pause a moment to enjoy the grateful coolness. A little onward lies a discrowned monarch of the woods; he has fallen beneath the weight of years, and moss and wild vines are wreathing the upturned roots, while from the spot where he once flour-

ished are already springing other trees and of a totally different race.

4. How beautifully the sunshine breaks into the glade through the opening left by the ruined tree! See how it flickers through the maple's spreading branches, glancing with arrowy beams between the pagoda-like boughs of the hemlock, and touching with gold the dark leaves of the gnarled oak, while it falls like network upon the greensward, bringing out a thousand beauties before unseen. Look how the red berries of the serpent's-eye moss gleam out from their velvet sheaths, mark the pale beauty of yon clump of violets, whose perfume would betray their presence, even though we saw them not. Behold the gorgeous garb of that glowing wood-lily, lifting its head as if in wonder at this sudden intrusion of sunlight upon its royal retiracy.

5. Let us seat ourselves at the root of this rough old oak. The short grass lies thick beneath our feet, while a cushion of rich velvet moss is spread over the rustic couch we have chosen. Oh! we have driven a tiny snake from his covert, and he glides rapidly away from his woman-born enemy. The squirrel—the harlequin of the woods—bounds in antic mirth above our heads, and, as he looks down upon us with a sort of ludicrous gravity in his little black eyes, seems disposed to test our humor by showering his nut-shells in the midst of us. The rabbit gazes out from his hiding-place, and then, pointing his long ears in terror, leaps away to find some more secure retreat. Nor are there wanting sweet sounds in this sylvan

hall. High on the topmost bough of the tallest tree (for he is the most ambitious of warblers) is poised the bluebird, making the clear air echo with his rich notes. The gushing melody of the wood-robin comes at intervals like the bubbling over of a musical fountain, while blended in sweet concord come the voices of an indistinguishable throng of lesser songsters. And when, beneath the midday sun, the birds cease their carols, then we have the vague music of leafy harps, the distant murmur of a mountain stream, the quiet ripple of a woodland brook.

"Earth speaks in many voices: from the roar
Of the wild cataract, whose ceaseless din
Shakes the far forest and resounding shore,
To the meek rivulet, which seems to win
Its modest way amid spring's pleasant bowers,
Singing its quiet tune to charm earth's perfumed flowers.

"Earth speaks in many voices: from the song
Of the free bird which soars to heaven's high porch,
As if on joy's full tide it swept along
To the low hum which wakens when the torch
Summons the insect myriads of the night
To sport their little hour and perish in the light.

"Earth speaks in many voices: music breathes
In the sweet murmur of the summer breeze
That plays around the wild flower's pendent wreaths,
Or swells its diapason 'mid the trees
When eve's cold shadow steals o'er lawn and lea,
And day's glad sounds give place to twilight minstrelsy."

6. Reader, did you ever spend a day in the woods, loitering the hours away amid sights and sounds like

these, and wending your course homeward at nightfall with a handful of flowers, a bunch of moss, or a curiously knotted stick as your only visible reward, while the wise and practical notabilities who call themselves your friends would shake their heads, half in scorn, half in pity, of your idleness and folly? And did you not feel that the patience with which you listened to the lessons of narrow-minded worldliness was gained from the quiet teachings of Nature in her woodland temple?

7. Oh! it is good for the heart to give itself up to such pure and genial influences. Refreshing to the soul are these frequent draughts from the well-spring of truth. We learn prudence and circumspection and self-concealment in our intercourse with the world; but it is only in the presence of the works of God that we learn to commune with the living soul which he has breathed into our frail and perishing body. In the thronged marts of our busy cities so much is done by man, so many wonderful things are achieved by his enterprise and genius, that we are apt to forget the Creator who gave him power over all things earthly. But when we see around us the rich garniture of the fields, the hills clothed in verdure, the trees lifting their proud heads to heaven, the flowers opening their many-colored urns of incense to the breeze, when we hear no sounds but the voices of God's humbler creatures, then do we feel ourselves alone in the presence of the Most High. Then do we find that within the recesses of our hearts is a sanctuary where only God is worshiped; then

do we learn the mystery of faith and the peace of hope.

8. It was Wordsworth, was it not? who thanked God for the mountains, feeling in his utmost heart how much the sublimity of external life aided the soul in its lofty soarings to the infinite. May we not also thank the Creator in the same spirit for the lowly blossom which spangles the wayside, as if to show that the Being whose omnipotent hand could fix the mountain on its rocky base had yet the omniscient goodness to foresee and provide for the humblest wants of his creatures. As if to make us feel that the Almighty Creator was also our "Father in heaven."

9. Beautiful indeed are the wild flowers of our own dear land. They grow not in hedge-rows and beside the tiny cottage, but they hide within the forest, they climb the lofty mountain, they enamel our wide expanse of wilderness. Listen to the sweet utterance of "Eva the Sinless":

"They tremble on the mountain height,
The fissured rock they press,
The desert wild with heat and sand
Shares too their blessedness;
And wheresoe'er the weary heart
Turns in its dim despair,
The meek-eyed blossom upward looks
Inviting it to prayer.

"Each tiny leaf becomes a scroll
Inscribed with holy truth,
A lesson that around the soul
Should keep the dew of youth.

Bright missals from angelic throngs
In every wayside left:
How were the earth of glory shorn
Were it of flowers bereft!"

EMMA C. EMBURY, "American Wild Flowers."

THE TALIPOT-TREE.

1. THERE are few objects in the vegetable kingdom more remarkable and beautiful, or more useful to man, than the talipot-tree, which is a species of palm (the *Corypha umbraculifera* of Linnæus) peculiar to the island of Ceylon and the Malabar coast. It is said to be found also in the Marquesas and Friendly Islands. Robert Knox says that it is as big and tall as a ship's mast, but Cordiner gives more definite dimensions by stating that one which he measured was a hundred feet high and five feet in circumference near the ground. The stem of this tree is perfectly straight; it gradually diminishes as it ascends, the circumference of the upper part being about half that of the base; it is strong enough to resist the most violent tropical winds. It has no branches, and the leaves only spring from its summit. These leaves, which when on the tree are almost circular, are of such prodigious diameter that they can shelter ten or a dozen (Knox says from fifteen to twenty) men, standing near to each other.

2. The flower of the tree which shoots above the leaves is at first a cluster of bright yellow blossoms, exceedingly beautiful to the eye, but emitting an odor too strong and pungent to be agreeable. Before its development the flower is inclosed in a hard rind, which rind, upon the expansion of the flower, bursts with a sharp noise. The flower shoots pyramidically to a great height, frequently adding as much as thirty feet to the elevation of the tree. From the flower proceed the fruit or seeds, which are as large as cherries, and exceedingly numerous, but not eatable; they are only useful as seeds to reproduce and multiply the tree. It appears that the natives do not sow them, but leave that operation entirely to Nature. The flower and the fruit only appear once on one tree. Their appearance betokens that the tree has attained to old age, which, according to the natives, it does in a hundred years; Ribeyro, a Portuguese writer, says in about thirty years, which is more likely to be correct. As soon as the fruit or seeds are ripe, the tree dries up and decays so rapidly that in two or three weeks it is seen prostrate and rotting on the ground.

3. Knox asserts that if the tree be cut down before it runs to seed, the pith, largely contained within the stem, is nutritious and wholesome, and adds that the natives take this pith "and beat in mortars to flour, and bake cakes of it, which taste much like to wheat bread, and it serves them instead of corn before their harvest be ripe." We have not found these cakes mentioned by any other writer on Ceylon, but as Knox was so veracious and correct, we may admit that the

natives were accustomed to make them. A better-known fact about the uses of the inner parts of the tree is that sago is made from them. The stem or trunk of the talipot, like that of most other palms, is extremely hard without but soft and spongy within, the greater part of its diameter being a soft, brownish, cellular substance. The sago is made by beating the spongy part of the stem in a mortar, by which means the fecula is procured.

4. Still, however, the great usefulness of the tree is in its leaves. Growing on the tree, these leaves, when expanded, are of a beautiful dark-green color; but those chiefly used are cut before they spread out, and have, and retain for ages, a pale, brownish-yellow color, not unlike old parchment. Their preparation for use is very simple: they are rubbed with hard, smooth pieces of wood, which express any humidity that may remain, and increase their pliability, which is naturally very great. This wonderful leaf is made like a fan, and like a fan it can be closed or expanded, and with almost as little exertion. It is in fact used as a fan by the natives of Ceylon, and is at the same time their only umbrella and parasol; in addition to which uses it forms their only tent when they are in the field, and, cut up into strips, it serves them to write upon instead of paper.

5. The leaf is so light that an entire one can be carried in the hand; but as this, from its great size when expanded, would be inconvenient, the natives cut segments from it, which they use to defend themselves from the scorching rays of the sun or from the

rains. The narrow part is carried foremost, the better to enable those who use them to penetrate through the woods and thickets with which most of the country abounds. No handles are used, but the two sides of the leaf are grasped by the bearer. "This," says Knox, in his quaint manner, "is a marvelous mercy which Almighty God hath bestowed upon this poor and naked people in this rainy country!" He ought to have added in this hot country, for the heats of Ceylon, whose mean temperature is eighty-one degrees, are frequently and for long periods tremendous, and the talipot-leaf is quite as valuable a protection against them as against rain.

6. However much water may fall on the leaf, it imbibes no humidity, remaining dry and light as ever. The British troops, in their campaign in the jungles against the Cingalese in 1817 and 1818, found to their cost how excellent a preservative it was against wet and damp. The enemy's musketmen were furnished, each with a talipot-leaf, by means of which they always kept their arms and powder perfectly dry, and could fire upon the invading forces, while frequently the British muskets, which had no such protection, were rendered useless by the heavy rains and the moisture of the woods and thickets.

7. As tents, the talipot-leaves are set up on end. Two or three talipot umbrellas thus employed make an excellent shelter, and from being so light and portable, each leaf folding up to the size of a man's arm, they are admirably adapted for this important service. The chiefs, moreover, have regularly formed square

tents made of them. In these the leaves are neatly sewed together and laid over a framework; the whole is light, and can be packed up in a very small compass.

8. When used in lieu of paper, as we have mentioned, they are cut into strips (those which we have seen are about fifteen inches long by three broad), soaked for a short time in boiling water, rubbed backward and forward over a smooth piece of wood to make them pliable, and then carefully dried. The Cingalese write or engrave their letters upon them with a stylus, or pointed steel instrument, and then rub them over with a dark-colored substance, which, only remaining in the parts etched or scratched, gives the characters greater relief, and makes them more easy to read. The coloring matter is rendered liquid by being mixed with cocoanut oil, and when dry is not easily effaced. On common occasions they write on the leaf of another species of palm-tree, but the talipot is used in all government dispatches, important documents, such as title-deeds to estates, etc., and in their books. A Cingalese book is a bundle of these strips tied up together. As even the lawyers and the learned in this country are very deficient in chronological knowledge, great confusion occurs as to dates; and it is very common to see a Cingalese judge attempting to ascertain the antiquity of a document produced in court by smelling and cutting it.

9. The oil employed in the writing imparts a strong odor which preserves it from insects, but this odor is changed by age. The talipot, however, appears to have in itself a natural quality which deters the at-

tack of insects, and preserves it from the decay of age even without the oil. It may be worth while observing that the Cingalese, who engrave the most solemn of their deeds, such as the foundation of donations to a temple, on plates of fine copper, which are generally neatly edged with silver, always make these plates of precisely the same shape as the talipot strips used for writing.

10. Besides all the uses described, the Cingalese employ the talipot-leaf extensively in thatching their houses. They also manufacture hats from it; these hats are made with brims as broad as an outstretched umbrella, and are chiefly worn by women nursing, to defend them and their infants from the heat.

11. The talipot is not a very common tree at present, and is rarely seen growing by those who only visit the coasts of the island and do not penetrate into the interior. It seems to grow scattered among other trees in the forests.

ANONYMOUS, "The Wonders of the World."

A TALK ABOUT USEFUL PLANTS.

1. THE world is a great picture-book. Wherever we walk or ride over its surface we see the picture-stories on its stones and leaves. We see the grand procession of its seasons, the winds, the storms, heat and cold, sunlight and shadow, and we read in the rocks the history of the world. We have already observed that

Central American Vegetables.

the surface of the globe has been prepared by frosts and rains as a home for all useful and beautiful plants —the rose, the cotton-plant, the vine, the grass for the cattle of the field, the trees that give us shade and shelter, and other useful plants bearing fruits after their kind. Where there is soil of any kind we may find plants. Except in a few barren and desolate places, we shall find plants covering the entire surface of the ground, and even extending under water along all the coasts. Any spot of ground, if the climate be favorable, will be covered with plants in time. No matter how thin the soil, plants will begin to grow, and, dying, prepare a place for others. We may dig up barren sand, and put it in a warm place and give it water, and plants will appear. We may break up a stone and place the dry powder in a greenhouse, and in a few weeks it will be covered with a green film. If we examine this with a microscope, we shall find the soft slime that has gathered on the broken stone is formed of minute plants. Every stone wall along a country lane becomes in a few months covered with minute plants that we call lichens and mosses. Stagnant water in warm weather is soon tinted green, and a powerful glass will show in a single drop hundreds of fast-growing plants. We may leave a piece of bread in a closet, and find after a few days that it is spotted with mold, and this soft gray matter, we shall find, is a plant, a mold-plant. Everywhere in the air are the seeds of plants, ready at all times to spring up as new plants. In June and July, in the Northern and Middle States, any spot of soil left untouched for

ten days will be covered with growing plants. In some of the Southern States not a spot of ground remains undisturbed more than a few weeks at any time without new plants appearing as by magic. We can dig up the subsoil anywhere and scatter it upon the surface in June, and it will soon be green. We can dig up a frozen clod from the garden in January and put it in a flower-pot in a warm window, and in a few days after it has thawed and dried, plants of some kind will begin to grow. There may be soils in deserts, but there is no rain. There may be soils in Greenland, but it is always winter. Wherever there is a soil and the right climate, we shall find plants.

2. Not only are there plants to be found in all parts of the earth, but there is every reason to think that they have been growing on some part of our globe for a very long time. Some of the plants we now see in our gardens are known to have been growing in China and Egypt three thousand years before Christ was born. That time is short indeed for others, and we must count backward millions on millions of years to the time when they first began to grow. The plants that grew in those old days were probably very small, neither bearing fruit nor fit for food for animals. Then there came slowly better and larger plants. There were new soils and new climates, and the plants, finding new conditions in which they must live, changed their shape and size, and became new kinds and new varieties. The Creator was in no haste. A few millions of years made no difference in his work, and no doubt the plants, left to

themselves, grew up to the tribes and families in which they now appear. In time many plants of strange forms and gigantic stature appeared and spread over the earth, and then disappeared utterly, so that we can not find any like them now living. Even to this day we can not be sure that we have found all the kinds and varieties of plants that grow. Some traveler may bring back from South America or Africa a new plant that has no name, and is not described in any of our lists of plants. There are also other plants that seem to be disappearing, and perhaps in a few years not one of their kind can be found in the world.

3. While plants now cover almost the whole of the land surface of the earth, and while we may be sure that they have been growing here for countless centuries on centuries, we must notice that not all plants are equally useful either as food for ourselves or for cattle, or useful for other purposes. Millions on millions of plants grow every summer in this country that are of no use whatever. Many more are an injury, because growing where better plants should grow; many are harmful and troublesome, and some are even poisonous. It has always been so since men began to live on the earth, and it probably took a very long time to discover which of all the many varieties of plants were really good and useful. There is every reason to think that plants appeared and grew upon the earth millions of years before the first men came to eat their fruits. These men, far back in the unknown past, were poor, starving creatures, dwell-

ing in trees and in caves, and with only sticks for arms and stones for tools. They found certain plants bore fruits, that the leaves of others were soft and succulent and fit to eat, or had roots that were fit for a cold breakfast. We can not tell when it happened; a million years ago, perhaps longer. No one can tell when or where men first saw that certain plants were pleasant to the eye and good for food. In time the art of cooking was invented, and then the number of plants fit for food greatly increased, because many plants that were not fit to eat raw could now be used.

4. Some prehistoric discoverer also learned that the pith or interior parts of certain plants could be made into cloths for garments and tent-covers. Other discoverers learned that certain trees gave wood admirable for bows and for spears. At first, and perhaps for many thousand years, all plants grew wild and took care of themselves. The idea of planting seeds and cultivating the ground about the young plants was a great step in advance. As soon as men began to do this they learned that the plants were greatly improved, and that they themselves, their wives and children could live in greater comfort and safety. When they depended alone on wild fruits, nuts, and berries they were little better than wild beasts. When they began to cultivate plants, men became something like civilized human beings. So it has been since men began to care for plants. The more they cultivated them, the more civilized they became, the greater the variety and the value of the wealth they won from the ground.

5. Then another curious thing happened. When men began to cultivate plants they gained more food to eat, better garments to wear, and greater comfort in living, and learned that the plants were likewise improved. The first wild fruits were small and sour, or of very poor flavor. As soon as the plants were cultivated the fruits grew larger and sweeter, and the crops were more abundant. The plants, finding themselves protected and allowed to grow in better soil, quickly took advantage of these things and changed their character, becoming larger and stronger, and bearing more beautiful flowers and finer fruits. As men became more skillful, the plants improved still more and changed their character greatly, and new kinds appeared. To-day many of us might not recognize a wild apple if we found one on a tree in the woods, so small and poor would it appear beside the hundreds of beautiful kinds we see in the fruit stores. We see the wild rose by the roadside in June, and wonder how the Jacqueminot, the Sofrano, and La France could have come from such a plain, single flower as that. At one time these splendid beauties of the greenhouse did not exist, and there were only the small wild roses to be found anywhere. In the same way all our fine vegetables have come from a few small wild plants growing in the woods.

6. The work of cultivating and improving plants began before there were books or any means of recording events; or, as we say, in "prehistoric times." It may have been thousands of years before any man thought of such a thing as history. After a while

one man told another of the plants he had taken from the woods, and he repeated it to others. Still other men learned by experiment how to cultivate the soil and explained this to others who wished to learn, and thus in time there grew up the art of agriculture, or field-culture. A great many facts were collected and handed down from father to son, and at last these facts were written out and put in books. So we find the art of caring for plants is one of the oldest arts in the world. Men also began to study plants as living things, without regard to their being useful or not, and there grew up the science of botany. This science has given names to plants, has classified them, or arranged them into groups and families, and has gathered a great many facts as to how plants live and grow. Botany includes the study of all plants, both wild and useful plants. It is a delightful and most interesting science, and will repay years of study.

CHARLES BARNARD, "Talks about our Useful Plants."

SUBTERRANEAN VEGETATION.

1. OF all the phenomena which attract the naturalist's attention, as he wanders over the surface of the earth, there is none which makes a deeper impression on his mind than the omnipresence of life. On the snow-clad cone of Chimborazo, eighteen thousand feet above the level of the sea, Humboldt found butterflies and other winged insects, while high over

his head the condor was soaring in solitary majesty. At the still greater elevation of 18,460 feet, at the Doonkiah Pass in the Himalaya Mountains, Dr. Hooker plucked flowering plants, and saw large flocks of wild geese winging their flight above Kanchinjinga (28,100 feet) toward the unknown regions of central Asia. Thus man meets with life as far as he is able to ascend, or as far as his sight plunges into the atmospheric ocean. Besides the objects visible to his eye, innumerable microscopical organisms pervade the realms of air.

2. According to Ehrenberg's brilliant discovery, the impalpably fine dust which, wafted by the Harmattan, often falls on ships when hundreds of miles from the coast of Africa, consists of agglomerations of silica-coated diatoms, individually so small as to be invisible to the naked eye, and everywhere numberless minute germs of future life—eggs of insects and sporules of cryptogamic plants—well fitted by cilia and feathery crowns for an aërial journey, float up and down in the atmosphere; while the waters of the ocean are found in like manner filled with myriads of animated atoms. But organic life not only occupies those parts of our globe which are accessible to solar light; it also dives profoundly into the subterranean world, wherever rain or the melted snow, filtering through the porous earth or through vents and crevices, is able to penetrate into natural caverns or artificial mines. For the combination of moisture, warmth, and air is able to develop organic life even thousands of feet below the surface of the earth, while light, though indispensable to most

creatures, would blight and destroy the inhabitants of the subterranean vaults.

3. On surveying the flora of these dismal recesses, we find it consisting exclusively of mushrooms or fungi, the lowest forms of vegetation, which, shunning the light, love darkness and damp. Their appearance in the caves is, as everywhere else, dependent upon the existence of an organic basis, and thus they are most commonly found germinating on pieces of wood, particularly in a state of decomposition, which have been conveyed into the caverns either through the agency of man or by the influx of water. Species of a peculiarly luxuriant growth are sometimes seen to spread over the neighboring stones, or apparently to spring from the rocky ground, where, however, on closer inspection, vestiges of decayed organic substances will generally be detected.

4. Thus vegetation in caves most commonly keeps pace with the quantity of moldering wood which they contain, and flourishes not only near their entrance but in their deepest recesses, as, for instance, in the Cave of Adelsberg, where at a distance of more than a thousand fathoms from its entrance the pegs which have been driven into the stalactital walls for the purpose of measuring its length are covered with a rich coat of fungi. Nothing can be more curious than to see these plants, thriving and luxuriating in deep stillness and gloom, under circumstances so alien to the ordinary conditions of life. Among the fungi found in caves, many also vegetate upon the surface of the earth exposed to the influence of light, and not

seldom degenerate into monstrous forms in their less congenial subterranean abodes; but many are the exclusive children of darkness. The Austrian naturalist Scopoli published in 1772 the first exact description of more than seventy subterranean fungi, collected chiefly in the mines of Schemnitz and Idria, and about twenty years later Humboldt wrote his celebrated treatise on the same subject. Since then G. F. Hoffmann has described the subterranean flora of the Harz Mountains, and latterly the botanists Welwitsch and Pokorny have examined the caves of Carinthia, where they discovered no less than eighteen species of fungi, among others the mouse-tail mushroom (*Agarious myurus*, Hoffm.), which is also found in the Harz, and bears on a slender hairy stalk, more than a foot long, a small hat, scarcely a quarter of an inch in diameter. Some of these fungi are remarkable for their size (*Thelephora rubiginosa sanguinolenta*), others for their elegance (*Diderma nigripes*).

5. Some years ago a gigantic fungus, found growing from the woodwork of a tunnel near Doncaster, England, afforded a striking proof of the luxuriance of subterranean vegetation. It measured no less than fifteen feet in diameter, and was, in its way, as great a curiosity as one of the colossal trees of California.

6. Even the plants that flourish in the darkness of caves have been rendered subservient to our use. The cultivation of the edible mushroom in spacious caverns or ancient quarries is practiced to a great extent in the environs of Paris, at Arcueil, Moulin de la Roche, and Saint-Germain, but particularly at Mont-

rouge, on the southern side of the city. The mushroom beds are entirely underground, seventy or eighty feet below the surface, at a depth where the temperature is nearly uniform all the year round. These extensive catacombs, formed by long, burrowing galleries, have no opening but by a circular shaft, to be descended by clambering down a perpendicular pole or mast, into the sides of which large wooden pegs are fixed, at intervals of ten or twelve inches, to rest the feet upon.

7. The baskets containing the ripe mushrooms are hoisted from below by a pulley and rope. The compost in which they grow consists of a white gritty earth, mixed with good stable manure, and is molded into narrow beds about twenty inches high, ranged along the sides of the passages or galleries, and kept exquisitely neat and smooth. The mushroom sporules are introduced to the beds either by flakes of earth taken from an old bed or else from a heap of decomposing stable manure in which mushrooms have naturally been engendered. The beds are covered with a layer of earth an inch thick, the earth being merely the white rubbish left by the stone-cutters above. They must be well watered and removed after two or three months, when their bearing qualities are exhausted. In one of the caves at Montrouge alone there are six or seven miles of mushroom bedding, a proof that this branch of industry is by no means unimportant.

G. HARTWIG, "The Subterranean World."

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